

*МОДУЛ 1*

**1. Заглавие** Co-Mn oxides supported on hierarchical macro-mesoporous silica for CO and VOCs oxidation

**Автори** S. Todorova, J. Blin, A. Naydenov, B. Lebeau, D. Karashanova, H. Kolev, P. Gaudin, R. Velinova, L. Vidal, L. Michelin, L. Josien, D. Filkova, I. Ivanova, A. Dotzeva, K. Tenchev

**Резюме** The hierarchical macro-mesoporous silica (MMS) was used for a first time as a support for catalysts for oxidation reactions. The macro-mesoporous silica was synthesized by the emulsions templating mechanism and modified separately or simultaneously using cobalt and manganese oxides. The obtained materials were characterized by different physicochemical methods and tested in the oxidation of CO and n-hexane combustion reactions. The modification of the MMS materials does not change significantly the mesopores characteristics; however, its pores are partially blocked by the oxides. For Co-MM sample agglomerates consisting of Co<sub>3</sub>O<sub>4</sub> with average size of 100–150 nm and small spherical aggregates, encapsulated in the mesopores are formed. The amorphous manganese oxide preferentially fills up the mesopores in Mn-MM sample. Mixed oxide Co-Mn phases situated in the mesoporous network are formed in the bi-component Co-Mn samples. No significant change is observed either in the texture, or in the structural features of the catalysts after reaction.

The highest catalytic activity for Co-MM sample in CO and n-hexane oxidation is related to the predomination of Co<sup>3+</sup> species on the surface of Co<sub>3</sub>O<sub>4</sub> and the more accessible oxide particles located outside the mesopores. The encapsulation of mixed Co-Mn oxides particles in the pores of the macro-mesoporous silica is responsible for a lower catalytic activity in comparison with that of the mono-component cobalt sample.

**Списание** [Catal Today 361 \(2021\) 94](#)

**2. Заглавие** Characteristics and properties of chromium coatings with diamond nanoparticles deposited directly on aluminum alloys

**Автори** V. Petkov, S. Simeonova, M. Kandeва, R. Valov

**Резюме** The objective of this study was to deposit directly chromium with diamond nanoparticles (ND) on aluminum alloys and investigate the coating surface. The chromium coatings on aluminum alloys were obtained by electrochemical deposition. The coatings were doped with ND. The diamond nanoparticles were obtained by detonation synthesis. Chromium coatings were deposited on aluminum alloys with a silicon content of 7 % and 10 %. The ND concentration in the electrolyte was 25 g/l. The surface analysis was performed by means of Atomic force microscopy. The surface of the coating of chromium with ND on Al<sub>10</sub>Si is twice more even than that on Al<sub>7</sub>Si. The microstructure and microhardness were examined with a metallographic microscope and a microhardness tester. The microhardness of the coated samples is 9163 MPa compared to 893 MPa of uncoated aluminum samples. The

thickness of the chromium coatings doped with diamond nanoparticles is between 45 – 55  $\mu\text{m}$ . The coatings are dense, continuous and uniform with good adhesion to the substrate material.

Списание [Arch Foundry Eng 20\(4\) \(2020\) 115](#)

### **3. Заглавие** Dioxin-annulated 1,8-naphthalimides – Synthesis, spectral and electrochemical properties, and application in OLED

**Автори** Y. Zagranjarski, M. Mutovska, P. Petrova, R. Tomova, P. Ivanov, S. Stoyanov

**Резюме** A synthetic approach for preparation of a new class of 1,8-naphthalimide derivatives with fused benzo and naphtho-dioxin systems is reported. The proposed reaction conditions for the first step allow selective bromination of 1,8-naphthalic anhydride to the corresponding 3,4,6-tribromo derivative, which has the potential to be versatile building block in the chemistry of naphthalimides. The dioxin-annulated products were isolated in very good yields and their applicability for further modifications by metal-catalysed coupling reactions was proven. The synthesized fluorescent dyes showed media dependant emission and their photophysical and electroluminescent properties were evaluated with respect to their application in OLED. TGA measurements showed that all compounds are stable up to above 400 °C. The best OLED test device has turn-on voltage of 8 V; maximum luminescent intensity of 3031  $\text{cd/m}^2$ , and current efficiency of 6.9  $\text{cd/A}$ .

Списание [Dyes Pigm 184 \(2021\) 108585](#)

### **4. Заглавие** Size-segregated particulate matter from gasification of Bulgarian agro-forest biomass residue

**Автори** R. Ferreira, T. Petrova, A. Ferreira, M. Costa, I. Inaydenova, S. Atanassova-Vladimirova, B. Ranguelov

**Резюме** The main purpose of the present work was to evaluate the efficiency of the gasification process of three different types of agro-forest biomass residue (rapeseed, softwood, and sunflower husks) along with the characterization of size-segregated particulates' emissions. The experiments were carried out in a drop tube furnace (DTF), using two different gasifying agents ( $\text{O}_2/\text{N}_2$  and  $\text{O}_2/\text{N}_2/\text{CO}_2$ ) at atmospheric pressure and a constant temperature of 1000 °C. In focus was the effect of biomass and the gasifying agent on syngas composition ( $\text{CO}$ ,  $\text{H}_2$ ,  $\text{CH}_4$ , and  $\text{CO}_2$ ), cold gas and carbon conversion efficiency, and on the emissions of by-products, such as particulate matter (PM), known for having negative environmental and health impacts. The collected particulates were characterized by SEM/EDS and XPS analysis. The results reveal that: (i) the introduction of  $\text{CO}_2$  increased the production of  $\text{CO}$  and  $\text{CH}_4$  and syngas' lower heating value (LHV), thus leading to higher cold gas and carbon conversion efficiency; (ii)  $\text{CO}_2$  decreased the production of  $\text{H}_2$ , leading to lower  $\text{H}_2/\text{CO}$  ratio (between 0.25 and 0.9). Therefore, the generated syngas is suitable for the synthesis of higher hydrocarbons, (iii)  $\text{CO}_2$  lowered the emissions of char (cyclone) particles but increased the overall  $\text{PM}_{10-0.3}$ . Submicron size PM

was the dominant fraction (PM<sub>1-0.3</sub>) in O<sub>2</sub>/N<sub>2</sub> and (PM<sub>1.6-0.3</sub>) in O<sub>2</sub>/N<sub>2</sub>/CO<sub>2</sub>. Unimodal PM size distribution was observed, except for sunflower husks gasification in O<sub>2</sub>/N<sub>2</sub>/CO<sub>2</sub>; (iv) the SEM/EDS and XPS analysis confirmed that submicron-sized PM<sub>1-0.3</sub> contain above 80% of carbon associated to soot, due to incomplete oxidation, whereas in cyclone (char) particles, carbon decreased to about 50%. The SEM/EDS results showed that K and Cl are typical constituents of the submicron size PM, whereas the alkaline earth metals were detected mainly in fine and coarse particulates. Detailed analysis of the XPS (C1s) spectra showed that the most common oxygen-containing groups on the PM<sub>1</sub> surface were carbonyl and carboxyl

Списание [Energies 14\(2\) \(2021\) 385](#)

### **5. Заглавие** Single-step fabrication of oriented composite nanowires by pulsed laser deposition in magnetic field

**Автори** R. Nikov, A. Dikovska, G. Avdeev, G. Atanasova, D. Karashanova, S. Amoruso, G. Ausanio, N. Nedyalkov

**Резюме** In this work, we demonstrate a novel way of fabricating oriented composite nanowires consisting of arranged nanoparticles. The structures are produced by an advanced pulsed laser deposition technology involving the simultaneous ablation of two metal targets, Fe and Ag. The depositions are carried out in air at atmospheric pressure in the presence of a magnetic field by using nanosecond laser pulses delivered by a Nd:YAG laser system operating at its fundamental wavelength. Samples are thus produced composed by iron oxide and silver at different percentage ratios. Their morphology represents nanowires with few tens of microns in length and an orientation predominantly following the direction of the magnetic force lines. The study on the optical properties of the structures thus produced revealed plasmon resonance behavior in their transmission spectra with its position depending on the ratio between the two building materials. UV–vis spectra were also obtained with polarized light. Higher transmission was measured for light polarized perpendicular to the length of the nanowires, compared to the case of polarization parallel to the nanowires. The structures can find applications in the design of novel polarization and magneto-optics devices, as well as in nanoelectronics and spintronics.

Списание [Mater Today Commun 26 \(2021\) 101717](#)

### **6. Заглавие** Modification of graphene-like, hydrogenated amorphous, hydrogenated tetrahedralamorphous carbon and amorphous carbon thin films by UV-C light

**Автори** T. Milenov, I. Avramova, A. Dikovska, D. Karaivanova, P. Terziyska, S. Kolev, D. Karashanova, B. Georgieva, D. Dimov, V. Atanasov, E. Valcheva

**Резюме** The study aims to explore the effect of low fluence UV-C radiation on the structural quality of thin carbon films. We have modified single to few-layered nano-sized graphene-like films deposited by pulsed laser deposition (PLD) on ~300 nm SiO<sub>2</sub>/Si substrates and additionally different hydrogenated amorphous carbon a-C:H, tetrahedral amorphous carbon (ta-C:H) and amorphous carbon (a-C) thin carbon films. The modification was carried out by irradiation of the samples with UV-C lamps (Hg lamps  $\lambda = 254$  nm wavelength and fluence of about  $2 \times 10^{-3}$  W/cm<sup>-2</sup>) for 5- 30 min in air-atmosphere for graphene-like and up to 60 min for thin carbon films. The irradiated graphene-like films were oriented either at about 2 arcdeg to the impinging light, i.e. the light was almost parallel to the honey-comb plane of graphene film or perpendicular to the UV-C light. The thin carbon films were treated only by a light directed perpendicularly to the films' surface for 60 min. Films were studied before and right after UV-C modification by ellipsometry or profilometry, X-ray photoelectron and Raman spectroscopies to clarify the influence of the UV-C treatment. The most pronounced influence of the UV-C irradiation on the structural quality of the films was established on a-C:H and ta-C:H films where the sp<sup>3</sup> and the oxygen-containing radicals content decrease moderately and drops significantly, respectively. The influence of the UV-C irradiation directed almost parallel to the films' surface on the structural quality of the graphene-like films was slightly higher than that directed perpendicularly. No significant influence on the quality of a-C films synthesized or a-C:H films annealed at high temperatures (1020–1050) °C was observed.

**Списание** [Surf Interfaces 24 \(2021\) 101073](#)

**7. Заглавие** Synergistic effect in a two-phase laser procedure for production of silver nanoparticles colloids applicable in ophthalmology

**Автори** A. Nikolov, N. Stankova, D. Karashanova, N. Nedyalkov, E. Pavlov, K. Koev, H. Najdenski, V. Kussovski, L. Avramov, C. Ristoscu, M. Badiceanu, I. Mihailescu

**Резюме** This paper reports on the production of Ag nanoparticles (AgNPs) in a water solution based on a two-phase pulsed laser procedure in view of therapeutic ophthalmological applications requiring AgNPs size of  $\leq 10$  nm with a narrow size distribution. Nanoparticles of this size scale are capable of penetrating the complex ocular barriers, thus ensuring effective non-invasive drug delivery to the retina. Moreover, the ocular irritation, which is currently associated to the conventional ocular drug administration routes, would be avoided.

In the first phase, AgNPs larger than 20 nm were fabricated via laser ablation of a Ag target in water by irradiation with the fundamental wavelength ( $\lambda = 1064$  nm) generated by a Nd:YAG laser. During the second phase, to reduce the mean size of the as-obtained nanoparticles and properly adjust the size distribution, the water colloids were additionally irradiated with the ultraviolet harmonics (355 nm and 266 nm) of the same laser source. The effect of the key laser parameters - wavelength, fluence and laser exposure time - upon the nanoparticles morphology was studied. The most suitable post-ablation treatment of initial colloids was obtained by a consecutive irradiation with the third ( $\lambda = 355$  nm) and the fourth

( $\lambda = 266$  nm) harmonics of the fundamental laser wavelength. By using this approach, a synergistic effect between two mechanisms of light absorption by AgNPs was induced. As a result, contaminant-free colloids of AgNPs with sizes of less than 10 nm and quite a narrow size distribution with a standard deviation of 1.6 nm were fabricated.

The toxic effect of the as-produced AgNPs on Gram-positive and Gram-negative bacteria and *Candida albicans* was explored. The most efficient action was reached against *Pseudomonas aeruginosa* and *Escherichia coli*.

A potential application was proposed of the synthesized AgNPs colloidal aqueous solutions with antimicrobial action as a non-invasive method for ocular infections prevention and treatment.

Списание [Opt Laser Technol 138 \(2021\) 106850](#)

## **8. Заглавие** Effect of Milling Time on the Sensing Properties of Fly Ash Zeolite Composite ThinFilms

**Автори** K. Lazarova, S. Boycheva, M. Vasileva, D. Zgureva, T. Babeva

**Резюме** Thin films consisting of a sol-gel Nb<sub>2</sub>O<sub>5</sub> matrix doped with zeolite Na-X synthesized from fly ash through ultrasonic-assisted double stage fusion-hydrothermal alkaline activation were deposited by the spin-coating method. In order to improve the optical quality and sensing properties of the thin films zeolites were wet-milled for 60, 120 and 540 seconds prior to incorporation in the film. The liquid adsorption ability of thin films were tested by measuring the reflectance spectra prior to and after exposure to liquid acetone and the change in the reflection coefficient  $\Delta R$  of the films was calculated. The influence of milling time of zeolites on the sensing and optical properties of the films was studied.

Списание [Eng Proc 6\(1\) \(2021\) 55](#)

## **9. Заглавие** Polarization holographic gratings in PAZO polymer films doped with particles of biometals

**Автори** A. Stoilova, G. Mateev, D. Nazarova, L. Nedelchev, E. Stoykova, B. Blagoeva, N. Berberova, S. Georgieva, P. Todorov

**Резюме** The paper presents a study of the diffraction efficiency of polarization holographic gratings recorded in thin films of the azopolymer PAZO (poly[1-[4-(3-carboxy-4-hydroxyphenylazo) benzenesulfonamido]-1,2-ethanediyl, sodium salt]) doped with Cu(II) 3-amino-5,5'-dimethylhydantoin (CLP) and Ni(II) 3-amino-5,5'-dimethylhydantoin (NLP) at three different concentrations, namely 1, 2 and 5 wt.%. The influence of the dopants composition and concentration on the parameters of the polarization holographic gratings

recorded in the thin composite films has been discussed. The gratings are recorded with a He-Cd gas laser with wavelength 442 nm. The polarization of the recording beams was left and right circular and the recording angle was 20°. Along with the anisotropic grating in the volume of the media, surface relief is also formed. The diffraction efficiency kinetics is probed at 635 nm and the height of the relief gratings is determined by AFM. Diffraction efficiency ( $\eta$ ) higher than 30 % was achieved for the hybrid samples, as well as 585 nm surface relief height.

**Списание** [J Photochem Photobiol A: Chem 411 \(2021\) 113196](#)

**10. Заглавие** Glass formation and glass ceramics in the system CaO-GeO<sub>2</sub>-Li<sub>2</sub>O-B<sub>2</sub>O<sub>3</sub>-Re<sub>2</sub>O<sub>3</sub>(Re=Eu<sup>3+</sup>, Tb<sup>3+</sup>, Dy<sup>3+</sup>)

**Автори** Koseva, V. Nikolov, P. Tzvetkov, M. Gancheva, P. Ivanov, P. Petrova, R. Tomova

**Резюме** Glasses with different compositions were prepared from the oxide system CaO-GeO<sub>2</sub>-Li<sub>2</sub>O-B<sub>2</sub>O<sub>3</sub> in order to find out compositions, where after thermal treatment of the initial glasses crystallize Ca<sub>2</sub>GeO<sub>4</sub>, Ca<sub>5</sub>Ge<sub>3</sub>O<sub>11</sub> or Li<sub>2</sub>CaGeO<sub>4</sub> as a main phase. Glass-ceramics were obtained and crystallizing phases were determined. Ca<sub>2</sub>GeO<sub>4</sub>, Ca<sub>5</sub>Ge<sub>3</sub>O<sub>11</sub> and Li<sub>2</sub>CaGeO<sub>4</sub> regions of existence in the glass-ceramics were defined. The infrared spectra of pure and Eu<sup>3+</sup>, Tb<sup>3+</sup> and Dy<sup>3+</sup> doped glasses show some variations between glass structures depending on the glass composition. Excitation and emission spectra of the doped glasses were studied. All luminescence spectra contain the characteristic transitions of Eu<sup>3+</sup>, Tb<sup>3+</sup> and Dy<sup>3+</sup> ions. Some difference can be seen in the Eu<sup>3+</sup> doped and Tb<sup>3+</sup> doped glass spectra depending on the glass composition. Differences are slight in the Dy<sup>3+</sup> doped glass spectra. CIE coordinates of Eu<sup>3+</sup> doped glasses, Tb<sup>3+</sup> doped glasses and Dy<sup>3+</sup> doped glasses are located in the red, green-yellow-pink and yellow regions.

**Списание** [J Non Cryst Solids 552 \(2021\) 120442](#)

**11. Заглавие** Flexible and Transparent Polymer-Based Optical Humidity Sensor

**Автори** K. Lazarova, S. Bozhilova, S. Ivanova, D. Christova, T. Babeva

**Резюме** Thin spin-coated polymer films of amphiphilic copolymer obtained by partial acetalization of poly (vinyl alcohol) are used as humidity-sensitive media. They are deposited on polymer substrate (PET) in order to obtain a flexible humidity sensor. Pre-metallization of substrate is implemented for increasing the optical contrast of the sensor, thus improving the sensitivity. The morphology of the sensors is studied by surface profiling, while the transparency of the sensor is controlled by transmittance measurements. The sensing behavior is evaluated through monitoring of transmittance values at different levels of relative humidity

gradually changing in the range 5–95% and the influence of up to 1000 bending deformations is estimated by determining the hysteresis and sensitivity of the flexible sensor after each set of deformations. The successful development of a flexible sensor for optical monitoring of humidity in a wide humidity range is demonstrated and discussed.

Списание [Sensors 21\(11\) \(2021\) 3674](#)

**12. Заглавие** N-heterocyclic bis-carbene palladium complexes derived from functionalized naphthalimides – Synthesis, Structure elucidation and DFT study

**Автори** M. Dangalov, P. Petrov, N. Vassilev

**Резюме** Two new bis-carbene ( $\text{Pd}(\text{NHC})_2\text{Cl}_2$  and  $\text{Pd}(\text{NHC})(\text{NHC}')\text{Br}_2$ ) complexes derived from substituted 1,8-naphthalimides were synthesized. All complexes were fully characterized by NMR spectra, which indicate *trans* orientation of the NHC ligands.  $^1\text{H}$  and  $^{13}\text{C}$  NMR spectra of complex  $\text{Pd}(\text{NHC})_2\text{Cl}_2$  are influenced by existence of *trans-syn* and *trans-anti* rotamers. The dynamic behaviour in solution of the complex  $\text{Pd}(\text{NHC})_2\text{Cl}_2$  was studied by  $^1\text{H}$  NMR spectra in the temperature range of 293–403 K. The rotational barrier is experimentally estimated to 20 kcal/mol at 298 K. The DFT calculations reproduce the experimental data very well. The analysis of DFT calculations suggests electronic origin of the restricted rotation around Pd-C<sub>carbene</sub> bond. The electron-donating properties of reported system are situated between unsaturated and saturated five-membered ring NHC ligands.

Списание [J Mol Struct 1230 \(2021\) 129944](#)

**13. Заглавие** Selective Production of Phenol on Bifunctional, Hierarchical ZSM-5 Zeolites

**Автори** M. Popova, Á. Szegedi, M. Oykova, H. Lazarova, N. Koseva, M. Mihályi, P. Shestakova

**Резюме** Mono- and bimetallic Ni-, Ru- and Pt-modified hierarchical ZSM-5 materials were prepared by impregnation technique and characterized by X-ray diffraction (XRD),  $\text{N}_2$  physisorption, temperature-programmed reduction (TPR–TGA), ATR–FTIR and solid state NMR spectroscopy. Formation of finely dispersed nickel, ruthenium and platinum species was observed on the bimetallic catalysts. It was found that the peculiarity of the used zeolite structure and the modification procedure determine the type of formed metal oxides and their dispersion and reducibility. The samples' acidity was studied via FTIR spectroscopy of adsorbed pyridine. The changes in the zeolite structure were studied via solid-state NMR spectroscopy. The catalysts were investigated in a gas-phase hydrodeoxygenation, transalkylation and dealkylation reaction of model lignin derivative molecules for phenol production.

Списание [Molecules 26\(12\) \(2021\) 3576](#)

**14. Заглавие** Facilitated synthesis of Mg<sub>2</sub>Ni based composites with attractive hydrogen sorption properties

**Автори** E. Grigorova, P. Tzvetkov, S. Todorova, P. Markov, T. Spassov

**Резюме** Composites based on Mg<sub>2</sub>Ni with 5% activated carbon from apricot stones (ACAP) have been prepared by ball milling and subsequent annealing in hydrogen atmosphere. The purpose of the primary metal (Mg, Ni, and V) milling was to reduce the particle size and achieve a good contact between them, without forming intermetallic compounds. During hydriding/dehydriding at 300 °C the amount of the Mg<sub>2</sub>Ni phase progressively increased, and after 10 cycles about 50% Mg<sub>2</sub>(Ni,V) was achieved. The hydrogenation produced mainly Mg<sub>2</sub>NiH<sub>4</sub>, but small amounts of MgH<sub>2</sub> and VH<sub>x</sub> were also detected in the powder mixture. Relatively high hydrogen storage capacity and fast hydriding/dehydriding kinetics of the Mg<sub>2.1</sub>Ni<sub>0.7</sub>V<sub>0.3</sub>—5 wt.% ACAP composite were determined both from hydrogen gas phase and electrochemically.

Списание [Materials 14 \(8\) \(2021\) 1936](#)

**15. Заглавие** Corrosion Resistance of TiO<sub>2</sub> Films Grown on Stainless Steel

**Автори** S. Yordanov, B. Jivov, S. Simeonova, L. Lakov, V. Dyakova, M. Aleksandrova, M. Gacheva, I. Stambolova

**Резюме** Experimental Sm<sub>2</sub>O<sub>3</sub>-doped TiO<sub>2</sub> coatings on stainless steel test specimens were prepared by the sol gel method. The phase composition and micromorphology of the obtained experimental samples were investigated using AFM, XRD and SEM method. The protective properties of deposited coatings were studied in NaCl corrosive medium. Increased corrosion resistance was found in the examined Sm<sub>2</sub>O<sub>3</sub>-doped TiO<sub>2</sub> coatings, compared to non-doped TiO<sub>2</sub> samples.

Списание [Int J NDT Days IV\(4\) \(2021\) 243](#)

**16. Заглавие** Kinetics of galvanostatic anodic polarization of Zn in NaOH solutions and characterization of the resulting layers

**Автори** E. Lilov, V. Lilova, C. Girginov, S. Kozhukharov, S. Nedev, A. Tsanev, D. Yancheva, V. Velinova, D. Ilieva

**Резюме** The kinetics of film formation on zinc in water solutions of sodium hydroxide was investigated. The concentrations of the forming electrolyte were varied between 0.001 and 0.08 mol dm<sup>-3</sup>. The anodic polarization was carried out in galvanostatic regime with current densities between 5 and 35 mA cm<sup>-2</sup>. A point at which the rate of film formation changes was found on the kinetic curves. The dependencies of the slopes of the kinetic curves before and after this point, the position of this point, as well as the breakdown voltage on the concentration of the forming electrolyte, on the applied current density and on the temperature were investigated. By means of X-ray diffractometry and Raman spectrometry was found, that the formed film consists of polycrystalline zinc oxide. Further investigations using ATR-FTIR and XPS confirmed these observations and suggested the possible presence of small quantities of impurities in the layers. SEM and AFM studies show that in the initial stages of anodic polarization a film is formed, which fills the concavities of the metal surface and afterwards the electrode is covered with hexagonal plate-like crystals. Subsequently the surface becomes smoother again. Some thermodynamic considerations, as well as some additional experiments with sandwich structures formed on the electrode surface suggest that the shift in the kinetic curves is caused by a change in the specific resistivity of the layer, occurring at a temperature of about 305 K.

Списание [Mater Chem Phys 263 \(2021\) 124298](#)

**17. Заглавие** Determination of imidacloprid, cypermethrin and chlorpyrifos ethyl in water samples using high-performance liquid chromatography

**Автори** V. Mihaylova, B. Todorov, V. Lyubomirova, R. Djingova

**Резюме** A high-performance liquid chromatography method is developed and validated for determination of imidacloprid, cypermethrin and chlorpyrifos ethyl in water samples. Separation is performed with a chromatographic column C18 (Microsorb-MV, 100-5, C18, 150 × 4.6 mm) using a mobile phase consisting of methanol/water (70:30, v/v) at a flow rate of 0.5 mL min<sup>-1</sup> and UV detection at 205 nm. The method exhibits good linearity in the range of 1-1000 µg L<sup>-1</sup> for the analyzed pesticides. The percentage recovery of the method at three concentration levels (10, 100, and 1000 µg L<sup>-1</sup>) is within 98.6 to 101.6% for the three pesticides. The limit of quantification is low (0.51, 1.20 and 1.50 µg L<sup>-1</sup> for imidacloprid, cypermethrin and chlorpyrifos ethyl, respectively) which enables their determination in water samples at low concentration levels. A stability test of imidacloprid, cypermethrin and chlorpyrifos ethyl was also performed to predict their stability in surface water under variation of ambient temperature.

Списание [Bulg Chem Commun 53 \(1\) \(2021\) 55](#)

**18. Заглавие** Recovery of radionuclides with ionic liquids. I. Selective extraction of <sup>241</sup>Am

**Автори** I. Belovezhdova, B. Todorov, M. Bogdanov

**Резюме** 1-methyl-3-octylimidazolium saccharinate {[C<sub>8</sub>C<sub>1</sub>im][Sac]} – a hydrophobic but polar ionic liquid (IL) capable of capturing and liberating water in a controllable manner was employed as an extraction phase in the liquid–liquid extraction for the recovery of radioactive elements (<sup>241</sup>Am, <sup>137</sup>Cs and <sup>60</sup>Co) from aqueous solutions. The influence of factors such as IL/aqueous source ratio, pH and presence of complex-forming agents (citric acid, oxalic acid) on the extraction yield was comprehensively studied. The radionuclides were shown to possess different behavior under the same conditions, the latter being attributed, and further proved by theoretical speciation analysis, to the formation of species capable of interacting in a specific manner with the IL-phase. The results obtained showed the possibility for controllable and selective transfer between the IL and aqueous phases and resulted in the development of a simple procedure for extraction and concentration of <sup>241</sup>Am. The method developed proved successful in the monitoring of this radionuclide in drinking water samples.

**Списание** [Sep Purif Technol 262 \(2021\) 118303](#)

**19. Заглавие** A Preliminary Study of Chemical Profiles of Honey, Cerumen and Propolis of the African Stingless Bee *Meliponula ferruginea*

**Автори** M. Popova, D. Gerginova, B. Trusheva, S. Simova, A. N. Tamfu, O. Ceylan, K. Clark and V. Bankova

**Резюме** Recently, the honey and propolis of stingless bees have been attracting growing attention because of their health-promoting properties. However, studies on these products of African Meliponini are still very scarce. In this preliminary study, we analyzed the chemical composition of honey, two cerumen, and two resin deposits (propolis) samples of *Meliponula ferruginea* from Tanzania. The honey of *M. ferruginea* was profiled by NMR and indicated different long-term stability from *Apis mellifera* European (Bulgarian) honey. It differed significantly in sugar and organic acids content and had a very high amount of the disaccharide trehalulose, known for its bioactivities. We suggested trehalulose to be a potential marker for African stingless bee honey analogously to the recent proposal for Meliponini honey from Asia, South America, and Australia and demonstrated its easy discrimination by <sup>13</sup>C NMR. Propolis and cerumen were studied by GC-MS (gas chromatography-mass spectrometry). The samples contained mainly terpenoids (di- and triterpenes) but demonstrated qualitative and quantitative differences. This fact was an indication that possibly *M. ferruginea* has no strict preferences for resins used to construct and protect their nests. The antimicrobial and anti-quorum sensing properties of the two materials were also tested. These first results demonstrated that the honey, cerumen, and propolis of African stingless bees were rich in biologically active substances and deserved further research.

**Списание** [Foods 2021 10\(5\) \(2021\) 997](#)

## 20. **Заглавие** Co–Ce Oxides Supported on SBA-15 for VOCs Oxidation

**Автори** J.-L. Blin, L. Michelin, B. Lebeau, A. Naydenov, R. Velinova, H. Kolev, P. Gaudin, L. Vidal, A. Dotzeva, K. Tenchev, S. Todorova

**Резюме** Reported here are new data on the structural and catalytic properties of a series of mono-component cobalt and bi-component Co–Ce catalysts supported on SBA-15 (Santa Barbara Amorphous-15)). The catalysts performance has been evaluated by tests on combustion of methane, propane, and n-hexane. It was established that the preparation of the Co–Ce catalysts by the ‘two-solvent’ technique does not significantly change the mesoporous structure, however, its pores are clogging with the Co and Ce guest species. Cobalt and cerium are uniformly distributed and preferentially fill up the channels of SBA-15, but oxide agglomerates located on the surface are observed as well. The highest activity of the mono-component cobalt sample is explained by its higher reducibility as a result of lower interaction of the cobalt oxide with the SBA-15. The fine dispersion of cobalt and cerium oxide and their strong interaction in the channels of the SBA-15 molecular sieve, leads to the formation of difficult-to-reduce oxide phases and, consequently, to lower catalytic activity compared to monocomponent cobalt oxide catalyst. The synthesised mesoporous structure can prevent the agglomeration of the oxide particles, thus leading to the successful development of a new and stable catalyst for decreasing greenhouse gas emissions.

**Списание** [Catalysts 11\(3\) \(2021\) 366](#)

## 21. **Заглавие:** ALD Deposited ZnO:Al Films on Mica for Flexible PDLC Devices

**Автори:** Dimitrov, D., Z. Chen, V. Marinova, D. Petrova, C.Y. Ho, B. Napoleonov, B. Blagoev, V. Strijkova, K. Y. Hsu, S. H. Lin, and J. Y. Juang

**Резюме** In this work, highly conductive Al-doped ZnO (AZO) films are deposited on transparent and flexible muscovite mica substrates by using the atomic layer deposition (ALD) technique. AZO-mica structures possess high optical transmittance at visible and near-infrared spectral range and retain low electric resistivity, even after continuous bending of up to 800 cycles. Structure performances after bending tests have been supported by atomic force microscopy (AFM) analysis. Based on performed optical and electrical characterizations AZO films on mica are implemented as transparent conductive electrodes in flexible polymer dispersed liquid crystal (PDLC) devices. The measured electro-optical characteristics and response time of the proposed devices reveal the higher potential of AZO-mica for future ITO-free flexible optoelectronic applications.

**Списание** [Nanomaterials 11\(4\) \(2021\) 1011](#)

**22. Заглавие** Facilitated Synthesis of Mg<sub>2</sub>Ni Based Composites with Attractive Hydrogen Sorption Properties

**Автори** E. Grigorova, P. Tzvetkov, S. Todorova, P. Markov, T. Spassov

**Резюме** Composites based on Mg<sub>2</sub>Ni with 5% activated carbon from apricot stones (ACAP) have been prepared by ball milling and subsequent annealing in hydrogen atmosphere. The purpose of the primary metal (Mg, Ni, and V) milling was to reduce the particle size and achieve a good contact between them, without forming intermetallic compounds. During hydriding/dehydriding at 300 °C the amount of the Mg<sub>2</sub>Ni phase progressively increased, and after 10 cycles about 50% Mg<sub>2</sub>(Ni,V) was achieved. The hydrogenation produced mainly Mg<sub>2</sub>NiH<sub>4</sub>, but small amounts of MgH<sub>2</sub> and VH<sub>x</sub> were also detected in the powder mixture. Relatively high hydrogen storage capacity and fast hydriding/dehydriding kinetics of the Mg<sub>2.1</sub>Ni<sub>0.7</sub>V<sub>0.3</sub>—5 wt.% ACAP composite were determined both from hydrogen gas phase and electrochemically

**Списание** [Materials 14\(8\) \(2021\) 1936](#)

**23. Заглавие** Study of the Effect of Bending Deformation on the Performance of Flexible PolymerLayered Humidity Sensor

**Автори** K. Lazarova, S. Bozhilova, S. Ivanova, D. Christova, T. Babeva

**Резюме** Humidity-sensitive polymer, namely poly(vinyl alcohol-co-vinyl acetal) was deposited on a flexible poly(ethylene terephthalate) (PET) substrate pre-covered with sputtered Au:Pd thin layer in order to develop an optical flexible humidity sensor. Spin-coating method was applied for the thin polymer film deposition. The optical and sensing properties of the device were studied after repeated bending deformation in the range 25–1000 times. Transmittance measurements at different levels of relative humidity were conducted in order to examine the sensing properties of probed flexible sample. The influence of the number of bending deformations on performance of the sensor is studied and the possibility for its successful application is demonstrated and discussed.

**Списание** [Eng Proc 6\(1\) \(2021\) 6](#)

**24. Заглавие** Recognition of small areas of activity by the pointwise intensity-based dynamicspeckle analysis

**Автори** E. Stoykova, N. Berberova, B. Blagoeva, D. Nazarova, L. Nedelchev, A. Machikhin

**Резюме** Industrial inspection of processes by capture of speckle patterns often requires detection of a small activity area buried in a background. This work presents analysis of sensitivity of the dynamic speckle method by processing simulated and experimental correlated in time 8 bit encoded speckle patterns. Simulation of the patterns was done for an exponentially decreasing temporal correlation function of intensity fluctuations by Fresnel propagation of a monochromatic wave reflected from a delta-correlated in time phase screen and captured at different diameters and focal distances of the optical sensor objective lens. For the experiment, we used a 3D printed flat object with hollow sections that was covered with a transparent film and a droplet of a polymer solution and monitored the process of their drying. Both normalized and non-normalized processing algorithms were used.

**Списание** [Proc. SPIE 11782, Optical Measurement Systems for Industrial Inspection XII \(2021\) 117821U](#)

**25. Заглавие** Modelling of transmission for a stack of two Fizeau wedges with matched parameters

**Автори** E. Stoykova, D. Nazarova, M. Nenchev, M. Deneva

**Резюме** A conventional Fizeau wedge (FW) is built of two flat reflecting surfaces inclined at a small angle. They form a gap with linearly increasing thickness normally to the wedge ridge. Such FWs with apex angles of 5–100 microradians and 5– 1000 micrometers thickness find application in optical metrology, spectroscopy and laser spectral control. The apex angle, the reflection coefficients and the refractive index in the gap form a unique interference pattern on both FW's sides. To benefit from a large free spectral range of thin wedges and high spectral resolution of thick wedges, recently we proposed a stack of two FWs with matched parameters. Matching provides the same change of the resonant wavelength at the same lateral displacement of both wedges. The aim of this study is to develop a technique for calculation of the resultant transmission of the stack of two matched wedges at plane wave illumination that is based on determination of the number and optical path differences of the rays leaving the stack at a given point on its rear surface. Only rays with non-negligible contribution as an amplitude are taken into account. Numerical simulation and experimental verification are provided.

**Списание** [Proc. SPIE 11783, Modeling Aspects in Optical Metrology VIII \(2021\) 117830A](#)

**26. Заглавие** JPEG compression scheme in dynamic speckle imaging

**Автори** E. Stoykova, D. Nazarova, L. Nedelchev, J. Park

**Резюме** Application of the JPEG compression scheme to dynamic speckle patterns captured for visualization of faster or slower changes in 3D objects is analyzed. Compression efficiency is proven by simulation and experiment.

**Списание** [OSA Imaging and Applied Optics Congress, OSA Technical Digest \(2021\) DM1B.5](#)

**27. Заглавие** Tunable Polarization and Surface Relief Holographic Gratings in Azopolymer Nanocomposites with Incorporated Goethite ( $\alpha$ -FeOOH) Nanorods

**Автори** L. Nedelchev, G. Mateev, V. Strijkova, V. Salgueiriño, D. Schmool, N. Berberova-Buhova, E. Stoykova, D. Nazarova

**Резюме** We employ two approaches to tune the properties of concurrently inscribed volume polarization and surface relief gratings in nanocomposite thin films containing the azopolymer PAZO (poly[1-4-(3-carboxy-4-hydrophenylazo)benzensulfonamido]-1,2-ethanediyl, sodium salt]) and goethite ( $\alpha$ -FeOOH) nanorods. The first one is applied on the stage of sample preparation by varying the concentration of the goethite nanorods from 0% to 15%. Then, different angles between the recording beams are set in the holographic scheme, which allow us to obtain gratings with spatial periods in the range from 0.86 to 2.51  $\mu\text{m}$ . Surface relief modulation close to 300 nm is achieved as well as total diffraction efficiency in the  $\pm 1$  diffracted orders of more than 50%. The influence of the incorporated goethite nanorods on the properties of both volume birefringence and the surface relief grating are discussed

**Списание** [Photonics 8\(8\) \(2021\) 306](#)

**28. Заглавие** Chiral structures induced by elliptically polarized light in amorphous and liquid crystalline polymers

**Автори** B. Blagoeva, L. Nedelchev, D. Nazarova, N. Berberova-Buhoba, E. Stoykova, J. Park

**Резюме** Photoinduced chiral structures in four azopolymers (three amorphous and one LC) are quantified by the azimuth rotation angle  $\Delta\theta$ . Both kinetics of  $\Delta\theta$  and its dependence on the input ellipticity are presented.

**Списание** [OSA Imaging and Applied Optics Congress, OSA Technical Digest \(2021\) DM6E.7](#)

**29. Заглавие** Neutral organophosphorus ligands as a molecular lab for simultaneous detecting of Ag(I) ions

**Автори** M. Atanassova, R. Angelov, D. Gerginova, D. Karashanova

**Резюме** Study of the liquid-liquid extraction of Ag(I) ions with a series of phosphine oxides (trioctylphosphine, tributylphosphine, triphenylphosphine, and octyl(phenyl)-N,N-diisobutylcarbamoylmethylphosphine oxide) and phosphorus-containing calix[4]arene by the well-known method of slope analysis and determination of the process parameters are presented employing CHCl<sub>3</sub> and an ionic liquid, 1-alkyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide ([C1C4im+][Tf2N]) as diluents. The ligand effect on the complexation properties of Ag(I) is quantitatively assessed. The silver-containing extracts are examined by <sup>1</sup>H, <sup>31</sup>P NMR as well as by SEM and TEM approaches in order to viewing the cation coordination and ligands' binding mode inside, in the organic phase solution at micro-scale level. A conclusion can be made about aggregation in micelle formation of the calix[4]arene under study upon extraction of Ag(I) ion. A method employing thermogravimetric analysis (TGA) is also exploited for the determination of the solubility of CMPO ligand diluted in [C1C4im+][Tf2N]. Final conclusions are given highlighting the role of the diluent, molecular or ionic, in complexation processes and selectivity involving ligands with P=O donor group and various metal s-, p-, d- and f-cations. The Ag(I) ions have shown the best extraction behavior compared to the other ions in the +1 oxidation state. Indeed, the calix[4]arene derivative bearing four P=O functions at the lower rim, shows strongly enhanced extraction as well as pronounced separation abilities towards lanthanoids in an ionic liquid environment.

**Списание** [J Mol Liq 335 \(2021\) 116287](#)

**30. Заглавие** Influence of the size of Au nanoparticles on the photoinduced birefringence and diffraction efficiency of polarization holographic gratings in thin films of azopolymer nanocomposites

**Автори** N. Berberova-Buhova, L. Nedelchev, G. Mateev, E. Stoykova, V. Strijkova, D. Nazarova

**Резюме** This study is aimed to determine the influence of the size of gold (Au) nanoparticles (NP) doped in azopolymer PAZO (poly[1-[4-(3-carboxy-4-hydroxyphenylazo) benzenesulfonamido]-1,2-ethanediyl, sodium salt]) on the photoinduced birefringence of the nanocomposite thin films as well as on the diffraction efficiency of polarization holographic gratings recorded in them. For this reason, we used spherical Au NP with five different dimensions – 10, 20, 30, 40 and 50 nm. Concentrations of the NP in the nanocomposites varied from 0 a.u. (non-doped samples) to 16 a.u. where 1 a.u. corresponds to 0.015 wt %. Birefringence was induced with He–Cd laser ( $\lambda = 442$  nm) and measured at 635 nm using DPSS laser. We observe an enhancement of photoinduced birefringence, which is most pronounced for the Au NP with size 20 nm. The polarization holographic gratings were inscribed with two orthogonal circular polarizations (left- and right-handed). AFM measurements were performed

to determine the properties of the resulting surface relief gratings. Our results indicate that both the diffraction efficiencies and surface relief modulation of the gratings inscribed in the nanocomposite thin films are higher compared to those in the non-doped samples.

Списание [Opt Mater 121 \(2021\) 111560](#)

### **31. Заглавие** Highly Elastic Super-Macroporous Cryogels Fabricated by Thermally Induced Crosslinking of 2-Hydroxyethylcellulose with Citric Acid in Solid State

**Автори** N. Bozova, P. Petrov

**Резюме** Biopolymer materials have been considered a “green” alternative to petroleum-based polymeric materials. Biopolymers cannot completely replace synthetic polymers, but their application should be extended as much as possible, exploiting the benefits of their low toxicity and biodegradability. This contribution describes a novel strategy for the synthesis of super-macroporous 2-hydroxyethylcellulose (HEC) cryogels. The method involves cryogenic treatment of an aqueous solution of HEC and citric acid (CA), freeze drying, and thermally induced crosslinking of HEC macrochains by CA in a solid state. The effect of reaction temperature (70–180 °C) and CA concentration (5–20 mass % to HEC) on the reaction efficacy and physico-mechanical properties of materials was investigated. Highly elastic cryogels were fabricated, with crosslinking carried out at  $\geq 100$  °C. The storage modulus of the newly obtained HEC cryogels was ca. 20 times higher than the modulus of pure HEC cryogels prepared by photochemical crosslinking. HEC cryogels possess an open porous structure, as confirmed by scanning electron microscopy (SEM), and uptake a relatively large amount of water. The swelling degree varied between 17 and 40, depending on the experimental conditions. The degradability of HEC cryogels was demonstrated by acid hydrolysis experiments.

Списание [Molecules 26 \(21\) \(2021\) 6370](#)

### **32. Заглавие** Ultra-Short Laser Surface Properties Optimization of Biocompatibility Characteristics of 3D Poly- $\epsilon$ -Caprolactone and Hydroxyapatite Composite Scaffolds

**Автори** A. Daskalova, E. Filipov, L. Angelova, R. Stefanov, D. Tatchev, G. Avdeev, L. Sotelo, S. Christiansen, G. Sarau, G. Leuchs, E. Iordanova, I. Buchvarov

**Резюме** The use of laser processing for the creation of diverse morphological patterns onto the surface of polymer scaffolds represents a method for overcoming bacterial biofilm formation and inducing enhanced cellular dynamics. We have investigated the influence of ultra-short laser parameters on 3D-printed poly- $\epsilon$ -caprolactone (PCL) and poly- $\epsilon$ -caprolactone/hydroxyapatite (PCL/HA) scaffolds with the aim of creating submicron geometrical features to improve the matrix biocompatibility properties. Specifically, the present

research was focused on monitoring the effect of the laser fluence (F) and the number of applied pulses (N) on the morphological, chemical and mechanical properties of the scaffolds. SEM analysis revealed that the femtosecond laser treatment of the scaffolds led to the formation of two distinct surface geometrical patterns, microchannels and single microprotrusions, without triggering collateral damage to the surrounding zones. We found that the microchannel structures favor the hydrophilicity properties. As demonstrated by the computer tomography results, surface roughness of the modified zones increases compared to the non-modified surface, without influencing the mechanical stability of the 3D matrices. The X-ray diffraction analysis confirmed that the laser structuring of the matrices did not lead to a change in the semi-crystalline phase of the PCL. The combinations of two types of geometrical designs—wood pile and snowflake—with laser-induced morphologies in the form of channels and columns are considered for optimizing the conditions for establishing an ideal scaffold, namely, precise dimensional form, mechanical stability, improved cytocompatibility and antibacterial behavior.

Списание [Materials 14\(24\) \(2021\) 7513](#)

### **33. Заглавие** Carbon screen-printed electrodes for substrate-assisted electroless deposition of palladium

**Автори** R. Ivanov, C. Czubala, C. Teichert, M. Bojinov, V. Tsakova

**Резюме** Five types of carbon-based screen-printed electrodes (SPE) – carbon (C110), mesoporous carbon (MC), single walled carbon nanotubes (SWCNT)-, carbon nanotubes (CNT)-, and carbon nanofibers (CNF)-modified electrodes – are characterized with respect to surface roughness, true surface area (TSA), electrochemical activity and electrochemical impedance (EIS) behavior and further used for electroless deposition of Pd. Structural characterization was performed by scanning electron microscopy (SEM) and atomic force microscopy (AFM). Investigation of the surfaces with AFM revealed an increasing root mean square (RMS) roughness in the order C110, SWCNT, CNT, CNF, and MC. EIS studies demonstrate significant difference in the resistance of the SPEs with largest value found for the carbon electrode (C110), followed by the carbon nanofiber (CNF)-modified electrode. MC, CNT- and SWCNT-modified electrodes exhibit close, significantly lower resistance values. The capacitance of the carbon-based SPEs is found to be rather high for all electrodes even if accounting for the TSA which has been determined with AFM. This implies a significant effect of nanoroughness and/or of a large internal porous structure especially for CNF and MC SPEs.

Pd electroless deposition occurs at all carbon-based SPEs after reductive pre-treatment in supporting electrolytes ( $0.5 \text{ mol dm}^{-3} \text{ H}_2\text{SO}_4$  or  $0.1 \text{ mol dm}^{-3} \text{ LiClO}_4$ ) without using a solute chemical reductant in the metal plating solution. The amount and characteristics of the deposited Pd is estimated by anodic stripping voltammetry, EDX analysis, and SEM. It is established that the type and amount of Pd deposit depends on the structure of the carbon-based electrodes with nanostructured carbon coatings (consisting of CNT, SWCNT, or CNF)

providing higher amounts of deposited Pd (in the range of 4.4 to 5.8  $\mu\text{g cm}^{-2}$ ) and smaller size of the obtained metal particles.

Списание [J Electroanal Chem 897 \(2021\) 115617](#)

**34. Заглавие** Acetone-Sensitive Thin Films Comprising Coal Fly Ash Na-X Zeolites and Sol-GelNb<sub>2</sub>O<sub>5</sub> Matrix

**Автори** К. Lazarova, S. Boycheva, M. Vasileva, D. Zgureva-Filipova, B. Georgieva, T. Babeva

**Резюме** In this study, thin composite films of a sol-gel Nb<sub>2</sub>O<sub>5</sub> matrix doped with coal fly ash Na-X zeolites were deposited by the spin-coating method. Fly ash of lignite coal collected from the electrostatic precipitators of one of the biggest TPPs in Bulgaria was used as a raw material for obtaining zeolites. Zeolite Na-X was synthesized by ultrasonic-assisted double stage fusion-hydrothermal alkaline conversion of coal fly ash. In order to improve the optical quality and sensing properties of the deposited thin films, synthesized zeolites were wet-milled for 60, 120, and 540 s prior to film deposition. The surface morphology of zeolite powders was studied both by scanning electron microscopy and transmission electron microscopy, while their porosity was investigated by N<sub>2</sub>-physisorption. Refractive index, extinction coefficient, and thickness of the films were determined through fitting of their reflectance spectra. The sensing ability of thin films towards acetone vapors was tested by measuring the reflectance spectra prior to and during exposure to the analyte, and the change in the reflection coefficient  $\Delta R$  of the films was calculated. The influence of milling time of zeolites on the sensing and optical properties of the films was assumed and confirmed

Списание [Nanomaterials 11\(9\) \(2021\) 2399](#)

**35. Заглавие** In Vitro Multiplication and NMR Fingerprinting of Rare Veronica caucasica M. Bieb

**Автори** D. Mantovska, M. Zhiponova, M. Georgiev, T. Grozdanova, D. Gerginova, K. Alipieva, S. Simova, M. Popova, V. Kapchina-Toteva, Z. Yordanova

**Резюме** Micropropagation of rare Veronica caucasica M. Bieb. was achieved by successful in vitro cultivation of mono-nodal segments on MS medium supplemented with 1.0 mg L<sup>-1</sup> 6-benzylaminopurine (BA) and then transferring the regenerated plants on hormone free basal MS medium for root development. In vitro multiplied plants were successively acclimated in a growth chamber and a greenhouse with 92% survival. The number of plastid pigments and the total phenolics content in in vitro cultivated and ex vitro adapted plants were unchanged, and no accumulation of reactive oxygen species (ROS) was detected by staining with 3-3'-diaminobenzidine (DAB) and 2',7'-dichlorofluorescein diacetate (DCF-DA). Nuclear Magnetic

Resonance (NMR) fingerprinting allowed for the identification of the major alterations in metabolome of *V. caucasica* plants during the process of ex situ conservation. Iridoid glucosides such as verproside, aucubin and catalpol were characteristic for in vitro cultivated plants, while in ex vitro acclimated plants phenolic acid–protocatechuic acid and caffeic acid appeared dominant. The successful initiation of in vitro and ex vitro cultures is an alternative biotechnological approach for the preservation of *V. caucasica* and would allow for further studies of the biosynthetic potential of the species and the selection of lines with a high content of pharmaceutically valuable molecules and nutraceuticals.

Списание [Molecules 26\(19\) \(2021\) 5888](#)

### **36. Заглавие** Multilayer Graphene for Flexible Optoelectronic Devices

**Автори** V. Marinova, S. Petrov, B. Napoleonov, J. Mickovski, D. Petrova, D. Dimitrov, K.-Y. Hsu, S.-H. Lin

**Резюме** Graphene has attracted considerable interest as a prospective material for future electronics and opto-electronics. Here, the synthesis process of large area few layers graphene by Atmospheric Pressure Chemical Vapor Deposition (APCVD) technique is demonstrated. Quality assessments of graphene are performed and confirmed by Raman analysis and optical spectroscopy. Next, graphene was transferred on Polyethylene Terephthalate (PET) substrates and implemented as transparent conductive electrode in flexible Polymer Dispersed Liquid Crystal (PDLC) devices. Their electro-optical properties, such as voltage-dependent transmittance and flexibility behavior are measured and discussed. The stability of the sheet resistance after 1200 bending tests of graphene/PET structure is demonstrated. The obtained results open a great potential of graphene integration into the next generation Indium Tin Oxide (ITO) free flexible and stretchable optoelectronics.

Списание [Mater Proc 4 \(1\) \(2021\) 65](#)

### **37. Заглавие** Chiral Aminoalcohols and Squaric Acid Amides as Ligands for Asymmetric Borane Reduction of Ketones: Insight to In Situ Formed Catalytic System by DOSY and Multinuclear NMR Experiments

**Автори** Y. Nikolova, G. Dobrikov, Z. Petkova, P. Shestakova

**Резюме** A series of squaric acid amides (synthesized in 66–99% isolated yields) and a set of chiral aminoalcohols were comparatively studied as ligands in a model reaction of reduction of  $\alpha$ -chloroacetophenone with  $\text{BH}_3 \cdot \text{SMe}_2$ . In all cases, the aminoalcohols demonstrated better efficiency (up to 94% ee), while only poor asymmetric induction was achieved with the corresponding squaramides. A mechanistic insight on the in situ formation and stability at room

temperature of intermediates generated from ligands and borane as possible precursors of the oxazaborolidine-based catalytic system has been obtained by  $^1\text{H}$  DOSY and multinuclear 1D and 2D ( $^1\text{H}$ ,  $^{10/11}\text{B}$ ,  $^{13}\text{C}$ ,  $^{15}\text{N}$ ) NMR spectroscopy of equimolar mixtures of borane and selected ligands. These results contribute to better understanding the complexity of the processes occurring in the reaction mixture prior to the possible oxazaborolidine formation, which play a crucial role on the degree of enantioselectivity achieved in the borane reduction of  $\alpha$ -chloroacetophenone.

Списание [Molecules 26\(22\) \(2021\) 6865](#)

### **38. Заглавие** CO<sub>2</sub> Adsorption on Modified Mesoporous Silicas: The Role of the Adsorption Sites

**Автори** M. Ravutsov, Y. Mitrev, P. Shestakova, H. Lazarova, S. Simeonov, M. Popova

**Резюме** The post-synthesis procedure for cyclic amine (morpholine and 1-methylpiperazine) modified mesoporous MCM-48 and SBA-15 silicas was developed. The procedure for preparation of the modified mesoporous materials does not affect the structural characteristics of the initial mesoporous silicas strongly. The initial and modified materials were characterized by XRD, N<sub>2</sub> physisorption, thermal analysis, and solid-state NMR. The CO<sub>2</sub> adsorption of the obtained materials was tested under dynamic and equilibrium conditions. The NMR data revealed the formation of different CO<sub>2</sub> adsorbed forms. The materials exhibited high CO<sub>2</sub> absorption capacity lying above the benchmark value of 2 mmol/g and stretching out to the outstanding 4.4 mmol/g in the case of 1-methylpiperazine modified MCM-48. The materials are reusable, and their CO<sub>2</sub> adsorption capacities are slightly lower in three adsorption/desorption cycles.

Списание [Nanomaterials 11\(11\) \(2021\) 2831](#)

### **39. Заглавие** Study of sites and species during CO hydrogenation over silica-supported Co-Pd catalysts. Relation to performance in the process

**Автори** M. Shopska, H. Kolev, K. Aleksieva, I. Shtereva, K. Tenchev, S. Todorova, M. Fabian, G. Kadinov

**Резюме** Supported bimetallic catalysts of (Co + Pd)/SiO<sub>2</sub> system were studied in carbon monoxide hydrogenation. Comparative analysis showed that depending on precursor treatment mode the catalysts ranged in different rows of activity in CO conversion and selectivity to methane. Samples of best performance were obtained after pretreatment in Ar flow. Highly selective catalysts were synthesized by reduction at 450 °C determining low metal dispersion, high extent of alloying, and agglomeration. A low H<sub>2,100C</sub>/CO<sub>strong</sub> adsorbed gas ratio was ascribed to a great amount of bimetallic particles and concerned with a diminished number of

sites for multiply bonded CO species. Metal dispersion was low due to large Co particles, which enhanced CO dissociation and hydrogenation to CH<sub>4</sub>. In presence of bimetallic particles the reaction  $\text{CO} + 3\text{H}_2 = \text{CH}_4 + \text{H}_2\text{O}$  was hampered. A decreased H<sub>2</sub>O formation influenced the WGS reaction. Catalyst samples activated at higher temperatures had better selectivity. During the process, formation of bidentate carbonate species was registered. It was supposed that palladium impeded creation of the latter species and following decomposition to CO<sub>2</sub>. Active catalyst samples were prepared by reduction at 300 °C leading to higher unreduced cobalt quota and metal dispersion, and decreased alloy particle formation. Higher H<sub>2,100C</sub>/CO<sub>strong</sub> ratio values were assigned to pure Co and Pd particle segregation, i.e. availability of sites for multiplybonded CO species favoring a higher activity in CO dissociation and further hydrogenation. A higher amount of CO species on these samples was conducive to CH<sub>4</sub> formation, but also to CO<sub>2</sub> production. The latter reaction was facilitated by unreduced cobalt.

Списание [React Kinet Mech Catal 134 \(2021\) 303](#)

#### **40. Заглавие** New Approach toward Laser-Assisted Modification of Biocompatible Polymers Relevant to Neural Interfacing Technologies

**Автори** N. Stankova, A. Nikolov, E. Iordanova, G. Yankov, N. Nedyalkov, P. Atanasov, D. Tatchev, E. Valova, K. Kolev, S. Armyanov, D. Karashanova, N. Fukata

**Резюме** We report on a new approach toward a laser-assisted modification of biocompatible polydimethylsiloxane (PDMS) elastomers relevant to the fabrication of stretchable multielectrode arrays (MEAs) devices for neural interfacing technologies. These applications require high-density electrode packaging to provide a high-resolution integrating system for neural stimulation and/or recording. Medical grade PDMS elastomers are highly flexible with low Young's modulus < 1 MPa, which are similar to soft tissue (nerve, brain, muscles) among the other known biopolymers, and can easily adjust to the soft tissue curvatures. This property ensures tight contact between the electrodes and tissue and promotes intensive development of PDMS-based MEAs interfacing devices in the basic neuroscience, neural prosthetics, and hybrid bionic systems, connecting the human nervous system with electronic or robotic prostheses for restoring and treating neurological diseases. By using the UV harmonics 266 and 355 nm of Nd:YAG laser medical grade PDMS elastomer is modified by ns-laser ablation in water. A new approach of processing is proposed to (i) activate the surface and to obtain tracks with (ii) symmetric U-shaped profiles and (iii) homogeneous microstructure This technology provides miniaturization of the device and successful functionalization by electroless metallization of the tracks with platinum (Pt) without preliminary sensitization by tin (Sn) and chemical activation by palladium (Pd). As a result, platinum black layers with a cauliflower-like structure with low values of sheet resistance between 1 and 8 Ω/sq are obtained.

Списание [Polymers 13\(17\) \(2021\) 3004](#)

**41. Заглавие** Preparation, structural investigation and optical properties determination of composite films based on PAZO polymer doped with GeTe<sub>4</sub>-Cu chalcogenide particles

**Автори** A. Stoilova, D. Dimov, Y. Trifonova, V. Lilova, B. Blagoeva, D. Nazarova, L. Nedelchev

**Резюме** Composite films based on the azopolymer poly[1-[4-(3-carboxy-4-hydroxyphenylazo)benzenesulfonamido]-1,2-ethanediyl, sodium salt] doped with GeTe<sub>4</sub>-Cu chalcogenide particles have been prepared through electrospray deposition. Polarization microscopy was applied to study the films morphology. The transmittance coefficient (T), the reflectance coefficient (R), the refractive index (n), the extinction coefficient (k), the optical absorption coefficient ( $\alpha$ ) and the optical band gap ( $E_{opt\ g}$ ) of the composite films and of the pure azo polymer film were determined. A significant change in the optical properties of the composite films in comparison to the non-doped azo polymer film has been observed.

**Списание** [Eur Phys J Appl Phys 95\(3\) \(2021\) 30301](#)

**42. Заглавие** Electrospun Poly(Methyl Methacrylate)/TiO<sub>2</sub> Composites for Photocatalytic Water Treatment

**Автори** O. Stoilova, N. Manolova, I. Rashkov

**Резюме** Electrospinning was successfully used for the one-step fabrication of poly(methyl methacrylate) (PMMA) fibers loaded with an inorganic photocatalyst—titanium oxide (TiO<sub>2</sub>). By tuning the PMMA/TiO<sub>2</sub> ratio and the electrospinning conditions (applied voltage, needle tip-to-collector distance, and flow rates), PMMA/TiO<sub>2</sub> composites with selected organic/inorganic ratios, tailored designs, and targeted properties were obtained. The morphology of the electrospun composites was affected by the amount of TiO<sub>2</sub> incorporated into the PMMA fibers. In addition, the inorganic photocatalyst had an impact on the wettability, thermal stability, and optical properties of the electrospun composites. In particular, the surface wettability of the composites was strongly influenced by UV light irradiation and from hydrophobic became superhydrophilic. Moreover, PMMA/TiO<sub>2</sub> composites had enhanced tensile strength in comparison with those of bare PMMA mats. The electrospun PMMA/TiO<sub>2</sub> composites showed excellent photocatalytic efficiency against the model organic pollutant—methylene blue—which is very promising for the future development of membranes that are highly efficacious for photocatalytic water treatment.

**Списание** [Polymers 13\(22\) \(2021\) 3923](#)

#### **43. Заглавие** Design and Catalytic Behaviour of Hosted in Activated Carbon Foam $\text{Co}_x\text{Zn}_{1-x}\text{Fe}_2\text{O}_4$ Ferrites

**Автори** Т. Tsoncheva, R. Ivanova, N. Velinov, D. Kovacheva, I. Spassova, D. Karashanova, N. Petrov

**Резюме** Carbon foams with different surface functionality and tailored texture characteristics were prepared from mixtures containing coal tar pitch and furfural in different proportions. The obtained materials were used as a host matrix for the preparation of zinc- and cobalt-mixed ferrite nanoparticles. The texture, morphology, phase composition, and the related redox and catalytic properties of the obtained composites were characterized by low-temperature nitrogen physisorption, XRD, SEM, HRTEM, FTIR, Mössbauer spectroscopy, TPR and catalytic decomposition of methanol to syngas. The impact of the carbon support on the formation of Co- and Zn-mixed ferrites was discussed in detail using KIT-6 silica-based modifications as reference samples. The catalytic behavior of the ferrites was considered in a complex relation to their composition, morphology, location in the porous matrix and metal ions distribution in the spinel sub-lattices. The higher amount of furfural in the carbon foam precursor promoted the formation of cobalt-rich, more accessible and highly active methanol decomposition to syngas spinel particles.

**Списание** [Symmetry 13 \(8\) \(2021\) 1532](#)

#### **44. Заглавие** Bifunctional mesoporous hybrid sol-gel prepared silicas for $\text{CO}_2$ adsorption

**Автори** N. Velikova, I. Spassova

**Резюме** Bifunctionalized mesoporous silica materials were prepared by sol-gel method applying newly proposed sequence of addition of the used silanols in the systems tetraethylortosilicate (TEOS): Tris[3-(trimethoxysilyl)propyl] isocyanurate (ISC): bis[(3-trimethoxysilyl)propyl]amine (BTPA), TEOS: ISC: (3-mercaptopropyl)trimethoxysilane (MPTMS) (TEOS: ISC: MPTMS) and TEOS: BTPA: MPTMS. The bi-functionalized hybrid silicas were synthesized by co-condensation reaction between TEOS and silsesquioxane precursors in acidic media. Soft template approach for pore formation was applied with structural directing agent Pluronic P123. Mesitylene and KCl were used for improving the materials' texture. New sequences of addition of the silanol precursors into the reaction mixture were applied in order to achieve better distribution of the functional groups on the materials surface and for prevention of entrapment of the functional groups in the pore walls. The synthesized bi-functional hybrid mesoporous silicas were investigated by FTIR,  $\text{N}_2$ -physisorption, DTA/TG-MS, SEM, XPS and XRD techniques.  $\text{CO}_2$  adsorption properties of the synthesized bi-functionalized hybrids were investigated. It was found that the sequence of addition of silanol precursors, the type of the silsesquioxane precursors and the presence of isocyanurate groups have significant influence on the materials texture, morphology and  $\text{CO}_2$  sorption properties. The presence of isocyanurate groups in the hybrid silica framework

significantly improves the textural characteristics and CO<sub>2</sub> sorption capacities. The determined heats of adsorption evidenced CO<sub>2</sub> physisorption on the active sites of the hybrid materials.

Списание [J Sol-Gel Sci Technol 100 \(2021\) 326](#)

**45. Заглавие** A new approach for determination of botanical origin of monofloral bee honey, combining mineral content, physicochemical parameters and Self-Organizing maps

**Автори** Т. Voyslavov, Е. Mladenova, R. Balkanska

**Резюме** A new approach for the botanical origin determination of monofloral bee honey is developed. The methodology combines mineral content and physicochemical parameters determination with intelligent statistics such as self-organizing maps (SOMs). A total of 62 monofloral bee honey samples were analysed, including 31 linden, 14 rapeseed, 13 sunflower, and 4 acacia. All of them were harvested in 2018 and 2019 from trusted beekeepers, after confirming their botanical origin, using melissopalynological analysis. Nine physicochemical parameters were determined, including colour, water content, pH, electrical conductivity, hydroxymethylfurfural content, diastase activity, specific optical rotation, invertase activity, and proline. The content of thirty chemical elements (Ag, Al, As, B, Ba, Bi, Ca, Cd, Co, Cr, Cs, Cu, Fe, Ga, In, K, Li, Mg, Mn, Na, Ni, P, Pb, Rb, S, Se, Sr, Te, V, and Zn) was measured using ICP-OES, ICP-MS, and FAAS as instrumental techniques. The visualisation of the SOMs shows an excellent separation of honey samples in five well-defined clusters—linden, rapeseed, acacia, sunflower, and polyfloral honey—using the following set of 16 descriptors: diastase activity, hydroxymethylfurfural content, invertase activity, pH, specific optical rotation, water content, Al, B, Cr, Cs, K, Na, Ni, Rb, V, and Zn.

Списание [Molecules 26\(23\) \(2021\) 7219](#)

**46. Заглавие** Facile preparation of novel antioxidant fibrous material based on natural plant extract from *Portulaca oleracea* and polylactide by electrospinning for biomedical applications

**Автори** М. Spasova, N. Stoyanova, N. Manolova, I. Rashkov, S. Taneva, S. Momchilova, A. Georgieva

**Резюме** For the first time, fibrous polylactide (PLA) materials containing plant extract of *Portulaca oleracea* obtained using supercritical carbon dioxide were successfully prepared by electrospinning. The effect of the extract concentration on the morphology and properties of the obtained materials was studied. *P. oleracea* extracts of 0–7.5 wt% in 10 wt% PLA solutions were electrospun. The optimal process conditions for the preparation of defect-free fibers were found. The newly obtained fibrous materials were fully characterized using scanning electron microscopy, Fourier transform infrared spectroscopy, differential scanning calorimetry, X-ray

diffraction analysis and water contact angle measurements. It was found that the incorporation of the crude extract had a significant effect on the average fiber diameter, thermal characteristics and structure of the obtained materials. Moreover, it was found that the electrospun PLA/*P. oleracea* materials showed high antioxidant activity. The cytocompatibility of fibrous mats was assessed and it was found that the materials loaded with *P. oleracea* enhanced the cell viability of mouse BALB/c-3T3 fibroblasts. Thus the obtained novel materials could be a potential candidate for tissue regeneration and wound healing applications.

Списание [Polym Int 71\(6\) 2021](#)

**47. Заглавие** Nickel-Decorated Mesoporous Iron–Cerium Mixed Oxides: Microstructure and Catalytic Activity in Methanol Decomposition

**Автори** Т. Tsoncheva, С. Rosmini, М. Mihaylov, J. Henych, К. Chakarova, N. Velinov, D. Kovacheva, Z. Ně meč ková, М. Kormunda, R. Ivanova, I. Spassova, К. Hadjiivanov

**Резюме** Nickel-decorated mesoporous cerium–iron oxide composites were synthesized by a combination of incipient wetness impregnation and template-assisted hydrothermal techniques. The effects of the Fe/Ce ratio and the calcination temperature of cerium–iron oxides on the phase composition, texture, structure, and redox properties of the composites were studied by a combination of N<sub>2</sub> physisorption, XRD, high-resolution transmission electron microscopy, SEM, Mö ssbauer, Raman, XPS, ultraviolet–visible and FTIR spectroscopies, H<sub>2</sub>-temperature-programmed reduction, and total oxidation of ethyl acetate as a catalytic test. The combined physicochemical characterization and in situ FTIR investigation of methanol decomposition was used for a proper understanding of the microstructure of the Ni/FeCe oxide composites and the mechanism of the reaction occurring on them. The complex role of the FeCe support in the stabilization of highly dispersed Ni particles, the generation of surface intermediates, and the impact of the support phase transformation under the reaction medium are discussed

Списание [ACS Appl Mater Interfaces 14 \(2022\) 873](#)

**48. Заглавие** 1*H*-benzimidazole-2-yl hydrazones as tubulin-targeting agents: Synthesis, structural characterization, anthelmintic activity and antiproliferative activity against *MCF-7* breast carcinoma cells and molecular docking studies

**Автори** К. Anichina, М. Argirova, R. Tzoneva, V. Uzunova, А. Mavrova, D. Vuchev, G. Popova-Daskalova, F. Fratev, М. Guncheva, D. Yancheva

**Резюме** In the present study, fifteen benzimidazolyl-2-hydrazones 7a-7o of fluoro-, hydroxy- and methoxy-substituted benzaldehydes and 1,3-benzodioxole-5-carbaldehyde were synthesized and their structure was identified by IR, NMR, and elemental analysis. The

compounds 7j 2-(3-hydroxybenzylidene)-1-(5(6)-methyl-1*H*-benzimidazol-2-yl)hydrazone and 7i 2-(3-hydroxybenzylidene)-1-(1*H*-benzimidazol-2-yl)hydrazone have exerted the strongest anthelmintic activity (100% after 24 h incubation period at 37 °C) against isolated muscle larvae of *Trichinella spiralis* in an *in vitro* experiment. The *in vitro* cytotoxicity assay towards *MCF-7* breast cancer cells and mouse embryo fibroblasts *3T3* showed that the studied benzimidazolyl-2-hydrazones exhibit low to moderate cytotoxic effects. The ability of the studied benzimidazolyl-2-hydrazones to modulate microtubule polymerization was confirmed and suggested that their anthelmintic action is mediated through inhibition of the tubulin polymerization likewise the other known benzimidazole anthelmintics. It was also shown that the four most promising benzimidazolyl-2-hydrazones do not affect significantly the AChE activity even at high tested concentration, thus indicating that they do not have the potential for neurotoxic effects. The binding mode of compounds 7j and 7n in the colchicine-binding site of tubulin were clarified by molecular docking simulations. Taken together, these results demonstrate that for the synthesized benzimidazole derivatives the anthelmintic activity against *T. spiralis* and the inhibition of tubulin polymerization are closely related.

Списание [Chem Biol Inter 345 \(2021\) 109540](#)

#### **49. Заглавие** Multivariate statistical assessment of Bulgarian bottled mineral and spring waters

**Автори:** V. Mihaylova, V. Lyubomirova, R. Djingova

**Резюме:** Water is essential to human life. Our bodies need a certain amount of water intake on a daily basis to function appropriately. Several health benefits have been attributed to the mineral and trace element content of mineral and spring waters. Although the quality of drinking water depends to a large extent on its microelement composition, only limited data are available about trace element content in Bulgarian bottled spring waters. In this study, using ICP-MS a simultaneous determination of 69 chemical elements in bottled spring waters has been performed and the results were compared to the previous analysis obtained for bottled mineral waters sold on the Bulgarian market. The data for both types of water (mineral and spring) prove that all determined elements are below Bulgarian Regulation No 9 of maximum admissible levels. Only Fe in one brand of spring water is slightly higher than Bulgarian health-based value but lower than EPA. Multivariate statistics (cluster, discriminant and factor analysis) were used to reveal groups of similarity among the investigated mineral and spring waters. For everyday use, along with the alternation of different brands of mineral water also change of the water type might be recommended.

Списание: [Bulg Chem Commun 53\(3\) \(2021\) 371](#)

**50. Заглавие** Influence of the Pre-Treatment and Post-Treatment Operations on the Surface Chemistry and Corrosion Behavior of Cerium-Based Conversion Coatings on Aluminum (book chapter)

**Автори** R. Andreeva, E. Stoyanova, A. Tsanev, D. Stoychev

**Резюме** We investigated the corrosion-protective action of chemically deposited in green Ce solution conversion Cerium oxide coatings on technically pure aluminum (Al 1050) that were subsequently immersion-treated in phosphate solutions. A comparative study was conducted regarding the effect of: the type of pretreatment of the Al substrate; the conversion treatment of the Al substrate in Ce-containing or P-containing solutions; the consecutive conversion treatment of the Al substrate in Ce-containing and P-containing solutions. The obtained results indicate that the pre-treatment of the aluminum substrate and the additional phosphate treatment of the Ce-oxide conversion coating deposited on Al 1050 have a strong impact on corrosion-protective effect. We established that the phosphate treatments lead to a transformation of the chemical composition, chemical state of the elements, structure and morphology of the Ce-oxide coatings formed on Al substrates. Oxides and phosphates of Al and Ce are formed, providing an effective barrier to the diffusion of Chloride ions towards the metal surface and increased corrosion resistance ( $R_p$ ) of Al 1050 to general and pitting corrosion. We have established a marked increase in  $R_p$  for one of the model systems (Al(NaOH)/CCOC(Ce+Cu)/PhL(NH<sub>4</sub>H<sub>2</sub>PO<sub>4</sub>)) during extended corrosion tests, which was related to the formation of poorly soluble surface corrosion products.

**Списание** [Current Adv Chem Biochem 7 \(2021\), ed. by A. Romero, Print ISBN: 978-93-91215-56-9, eBook ISBN: 978-93-91215-57-6](#)

**51. Заглавие** Приложение на ЯМР метаболомика за анализ на пчелен мед от мурсалски чай

**Автори** Д. Гергинова, Я. Митрев, С. Симова

**Списание** [Списание на БАН 4 \(2021\) 9](#)

## МОДУЛ 2

**1. Заглавие** The altar wall paintings of the catholicon “The Nativity of the Virgin”, Rila Monastery, Bulgaria: Identification of the painting materials by means of vibrational spectroscopic techniques complemented by EDX, XRD and TGA analysis

**Автори** В. Stamboliyska, S. Tapanov, E. Velcheva, D. Yancheva, M. Rogozherov, Z. Glavcheva, G. Lalev, M. Dimitrov

**Резюме** The purpose of the present study is to deepen our knowledge about the painting materials and technology characteristics of iconography during the Bulgarian National Revival. Our efforts have focused on studying the murals in the catholicon (main church) “The Nativity of the Virgin” of the Rila Monastery, which is one of Bulgarian leading historical monuments. A series of micro samples from the altar mural paintings were analyzed by a combination of attenuated total reflectance Fourier transform infrared (ATR-FTIR), micro-Raman spectroscopy, scanning electron microscopy energy dispersive X-ray spectroscopy (SEM-EDS), X-ray diffraction (XRD), thermogravimetric analysis (TGA) and Optical microscopy (OM). The data analysis showed that the painter's palette is made up of nine mineral pigments: smalt, chrome yellow, emerald green, vermilion, red lead, green earths, yellow ochre, sienna and calcite. The impression of rich colorful palette was achieved by using various pigment mixtures. The presence of egg binder in many paint samples suggested that the murals were executed by the traditional egg tempera technique, with the only exception of the smalt paint of the background where carbohydrate glue is present as binder.

**Списание** [Spectrochim Acta A Mol Biomol Spectrosc 247 \(2021\) 119087](#)

**2. Заглавие** Three Persian Qajar paintings from the National Gallery Sofia. Study of the technology and the composition materials for the purpose of dating and conservation evaluation

**Автори:** Y. Tavitian, D. Yancheva, N. Todorov

**Резюме:** Three Persian oil paintings on canvas from the collection of the National Gallery, Sofia, representing a Musician playing Daf, Musician playing Santour and Royalty/Prince, dating from the Persian Qajar era, created as marouflaged canvas murals, but dismantled, relined and converted to easel paintings at some point, were studied for the purpose of dating, conservation and technological evaluation. A series of micro-samples and cross sections were investigated by optical microscopy, energy dispersive X-ray spectroscopy in a scanning electron microscope (SEM-EDS), attenuated total reflectance Fourier transform infrared (ATR-FTIR), Raman spectroscopy and with non-destructive methods as X-ray, IR and UV-fluorescence imaging in order to characterize the protective coatings or varnishes, paint layers, primers, ground layers, lining adhesive components and canvases. The non-destructive investigation methods, the samples and cross sections studies with the analytical methods applied contributed to identify the composition and stratigraphy, identical for both paintings

with Musicians showing previous historical restorations. The data collected from the analysis of the Royalty/Prince painting also proved previous interventions, complex stratigraphy and presence of overpaintings. The integrated materials are similar for the three artworks. The analysis revealed a rich blend of predominant traditional materials and techniques with little new European impact, which allows dating the paintings back to the first quarter of the XIX century. The study of the composition of the paintings determines the direction of the conservation and restoration approaches.

**Списание:** [Eur Phys J Plus 136 \(2021\) 733](#)

**3. Заглавие** Спектроскопски анализ на стенописите в църквата „Успение на св. Йоан Рилски“, Рилски манастир

**Автори** Б. Стамболийска, С. Тъпанов, Е. Велчева, Д. Панталеева, С. Стоянов

**Резюме** Художествените ценности в църквата, за съжаление, постоянно са изложени на тежките условия на високопланинския климат, което неизбежно влияе отрицателно върху тяхното състояние. Това налага предприемане на съвременни мерки за опазване и реставрация на застрашените художествени произведения. А за да се проведе адекватно реставрацията на една творба, е необходимо да бъдат изяснени всички аспекти на нейната технология и реставрационната ѝ проблематика. Анализът на техниката и технологията често се явява ключ за успешното решаване на реставрационните задачи. С тази цел беше проведено аналитично проучване за изясняване на технологичните характеристики на стенописите в църквата „Успение на св. Иван Рилски“ и за идентифициране на използваните живописни материали и техники.

**Списание** [Списание на БАН 4 \(2021\) 29-36](#)

**4. Заглавие** "Време, материя и дух: Реставрацията в Националния археологически институт с музей при Българската академия на науките". Национален археологически музей каталози (Supplementum 2) (каталог към едноименната изложба)

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**5. Заглавие** [Цинобърът – цвят на царе и богове. Древната символика](#)

**Автори** Р. Манова

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**6. Заглавие** Царският цвят цинобър в тракийската и римската култура по българските земи

/ Cinnabar – the Royal Colour in Thracian and Roman Cultures in the Bulgarian Lands

Съставители В. Фол, Р. Попова, Р. Манова

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