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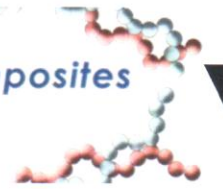
From Aerospace to Nanotechnology



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BOOK OF ABSTRACTS

17-21 JUNE 2018 ISCHIA - ITALY

A Formation of the Multifunctional Metal- Polymer Composite With Antiseptic, Anesthetic and Bactericidal Properties by Green Technologies

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Abstract. The preparation technique for multifunctional Ag-metal-polymer composites based on the commercial medical sponge Collachit-G with antiseptic, anesthetic and bactericidal properties has been developed. The immobilization of ibuprofen and AgNPs on Collachit-G was achieved by using combination of two green technologies: the treatment in supercritical carbon dioxide (SC CO_2) and metal-vapor synthesis (MVS). The composites were investigated by TEM and XPS. A drug-release process and its mechanism have been studied within the framework of the Ritger-Peppas model. It was found that ibuprofen content in the sponge reaches 51 % from its weight. The average linear size of Ag particles is 6 ± 1nm, and Ag atoms are in Ag^0 state. Duration of ibuprofen escape from initial sponge in the phosphate buffer with pH =7.4 is 3 hours. Diffusion obeys to Fick's law. The presence of Ag clusters in the sponge does not principally change the diffusion mechanism.

Keywords: Collachit, SC CO_2, metal-vapor synthesis, AgNPs, ibuprofen, drug-release.
PACS codes: 81.07.-b, 82.33.De, 87.85.J-.

Degradation-Relaxation Phenomenology in Nanocomposites: on the Linearized Kinetics Crossover

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Abstract. Phenomenological models of degradation-relaxation kinetics are considered for jammed systems like structurally-inhomogeneous nanocomposites, exemplified, in part, by screen-printed Cu0.1Ni0.1Co1.6Mn1.2O4 spinel ceramics with conductive Ag and Ag-Pd compound contacts. Nanoinhomogeneities due to Ag or Ag-Pd diffusants in a spinel environment are shown to define the governing kinetics of thermally-induced electrical degradation (at 170°C) obeying non-exponential behavior in negative relative resistance drift. Parameterization of this phenomenon (in part, determination of kinetics- responsible scaling exponent β) is shown can be simply performed within indirect linear least-square analysis applied to the generalized relaxation function presented in double-logarithmic plotting of variables. Crossover from stretched-exponential (stretching exponent $0<\beta<1$) to compressed-exponential (compressing exponent $\beta>1$) degradation kinetics is revealed in these nanocomposites dependently on contacting diffusant materials, i.e. conductive Ag-Pd ($\beta=0.58$) or Ag ($\beta=1.68$) compounds.

Keywords: relaxation; stretched-exponential, compressed-exponential, kinetics, spinel.
PACS: 82

Photoresponse of Inorganic-Organic Thin Film Composites Based on Chalcogenide Glasses

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Abstract. Spin coated chalcogenide thin films have different structural and chemical properties than the films obtained by traditional methods such as thermal evaporation or sputtering. The solution-based method provides lower sensitivity of glass matrix to the influence of bandgap and superbandgap light. This property is very useful for non-linear optical applications based on high transparency of these materials in infrared spectral region. Arsenic selenide spin coated thin films were obtained by chemical dissolution of bulk glasses in ethylenediamine. The influence of preparation conditions, especially the annealing temperatures at the final stage of thin films synthesis, on in-situ kinetics of photodarkening (bleaching) at various energies and intensities of UV-VIS light was studied. It was found that at certain annealing conditions only transient photoinduced effects can be obtained by eliminating metastable kinetic component. Mechanisms of the photoinduced effects are discussed based on the parameters of relaxation functions.

Keywords: Chalcogenide Glass; Thin Films: Spin-Coating; Photoinduced Effects; Inorganic-Organic Composites
PACS: 78.66.Sq; 78.66.Jg; 81.07.Pr; 67.60.gj; 42.70.Ce; 42.70.Gi

Mechanical Properties of Bimaleimide Matrix Composites and the Performance of its Component

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Abstract. Bismaleimide matrix composites (abbreviated as MT700/802) reinforced by domestic carbon fiber (MT700) were prepared by autoclave process. The properties of tensile, compressive and in-plane shear for quasi-isotropic laminates were comprehensively studied at room temperature and at -55 oC. The experimental results showed that 90o compressive strength and 0o in-plane shear strength at -55 oC were improved by 10% than those at room temperature, however, both of 0o and 90o tensile strength and modulus at -55 oC were reduced by near 9% than those at room temperature. Meanwhile, a component with local variable thickness was developed, and it was tested under the working condition of tensile and shear load. The results exhibited that the tensile failure load of the component run at 31.45 kN and the shear failure load was more than 54.11 kN.

Key words: Bismaleimide, Composites, Component, Tensile load, Shear load
PACS: 81.05.Qk

Thermal Degradation and Fire Properties of Epoxy Modified Resins

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Abstract. The flammability of the resin is a major limitation in the aeronautic applications where new developed materials for primary and secondary structures must fulfill special regulation in order to demonstrate that their level of fire safety is equivalent to a conventional transport (aluminum) material. In this paper, the attention is focused on the thermal properties and the fire behavior of TGMDA based epoxy resins in which carbon nanotubes and POSS have been dispersed at nanometric or molecular level. The effect of the hardener, the diluent and the nanoparticles on the thermal properties has been investigated. Thermogravimetric data have been modeled according to the Coats and Redfen equations which provide a fast method for the determination of the kinetics of thermal degradation of polymers. The char yield has been used as criteria for evaluating limiting oxygen index (LOI) of the resin in accordance with Van Krevelen and Hoftyzer equation and the results have been compared with the experimental LOI data

Keywords: Epoxy structural composite, flame behavior, LOI, TGA.
PACS: 65.80.-g, 82.35.Np, 81.70.PgR

Free-volume Structure of glass-As_2Se_3/PVP Nanocomposites Prepared by Mechanochemical Milling

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Abstract. Atomic-deficient void structure is studied in nanocomposites prepared by mechanochemical milling of glassy g-As_2Se_3 in a water solution of polyvinylpyrrolidone (PVP) employing positron annihilation lifetime spectroscopy. Formalism of Ps-to-positron trapping conversion known as x3-x2-CDA (coupling decomposition algorithm) is applied to identify free-volume defects in the pelletized g-As_2Se_3/PVP nanocomposite in respect to dry-milled g-As_2Se_3 one. Under wet-milling, the inter-nanoparticle Ps-decaying sites in preferential PVP environment replace free-volume positron traps (in dry-milled g-As_2Se_3) with defect-specific lifetime of 0.352 ns, corresponding to di-/tri-atomic vacancies in g-As-Se.

Keywords:, arsenic selenide, free-volume defect, nanoparticle, nanocomposite, positron annihilation, mechanical milling.
PACS: 78.67.Sc, 78.70.Bj