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Highlights from MRS Fellows

Review of materials science and technological applications of transformational integrated multifunctional oxide/ultrananocrystalline diamond (UNCD) films/crystalline diamond for new generation of high-tech and biomedical devices

Orlando Auciello

R&D on integration of multifunctional oxide and polycrystalline diamond films and crystalline diamond is enabling new generations of multifunctional high-tech and biomedical devices for impact on quality of life. The author describes the materials science and technological applications developed in recent years for transformational integration of key multifunctional oxides/UNCD films/crystalline diamond. https://doi.org/10.1557/s43578-023-00897-y

Advances in the measurement of hardness at high strain rates by nanoindentation

B.L. Hackett, P. Sudharshan Phani, C.C. Walker, W.C. Oliver, G.M. Pharr

The authors present a new testing system and techniques for measuring the hardness of materials subjected to very high indentation strain rates, accomplished by modifying the components of a conventional nanoindentation system with a laser interferometer that records indenter displacements at 1.25 MHz. Using specially developed analysis techniques, these displacements can be converted to synchronous measurements of the indentation load from which the hardness can be obtained. https://doi.org/10.1557/s43578-023-00921-1

Opportunities and challenges in integrating 2D materials with *inorganic* 1D/0D layered nanostructures

Tomojit Chowdhury, Reshef Tenne

The discovery of inorganic 1D nanotubes and 0D fullerenes allowed major new physicochemical observations. The rise of 2D materials in concert set off advances in the synthesis and manipulation of layered materials with atomic precision. The authors identify new directions that emerge through integrating the two layered systems—2D with *inorganic* 1D and 0D—into functional nanostructures. https://doi.org/10.1557/s43578-022-00843-4

Obtaining and characterization of a composite material with SBS and sargassum particles

Jessica L. García-Castañeda, Beatriz A. Salazar-Cruz, Gabriel Hernández-Zamora, José L. Rivera-Armenta, Cynthia G. Flores-Hernández, Ana Cecilia Espindola-Flores

The application of natural reinforcements in the synthesis of composites has seen a huge increase; however, little effort has been made for employing organic waste or invasive plants as these fillers. The authors used sargassum as the filler for the SBS rubber composites to enhance their mechanical properties, demonstrating an improvement in the tensile and morphological properties. https://doi.org/10.1557/s43580-022-00431-y

Thermo-mechanical analysis of seawater-conditioned carbon/polymer composites reinforced with nanoclay/graphene nanoparticles

Mohammad Al Ahsan, Md. Sarower Hossain Tareq, Mahesh Hosur, Alfred Tcherbi-Narteh

The use of polymer composites has attracted the scientific community for their superior properties compared with their metallic counterparts. The authors synthesized five different types of fiber-reinforced polymer composites and their performance under extreme conditions was tested. Nanoparticles improved the mechanical properties in composites compared to the pristine matrix and seawater conditioning affected their thermal and mechanical properties. https://doi.org/10.1557/s43580-021-00015-2

Inter-layer coatings for softening polymer-based neural interfaces

Adriana Carolina Duran-Martinez, Pedro Emanuel Rocha-Flores, Aldo Garcia-Sandoval, Yutika Ravindra Badhe, Ramyapriya Krishnasamy, Alexandra Joshi-Imre, Stuart F. Cogan, Walter E. Voit

Implantable electrodes for interacting with neural tissue need to be elastically compliant to minimize adverse interactions during placement and chronic use. Softening polymers, which decrease modulus in the presence of environmental changes, are applying, but have poor electrical properties. The authors demonstrate new routes to fabricate multilayered structures that meet both electrical and mechanical requirements for this application. https://doi.org/10.1557/s43580-021-00159-1

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