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Cold sintering of microwave dielectric ceramics and devices

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Microwave dielectric ceramics can be co-sintered with low melting point electrodes by cold sintering at <200°C, combining pressure and a transient liquid phase during densification, or direct integration with polymers at <200°C. The authors describe principles of cold sintering for component/device fabrication, present properties, and discuss future prospects for cold sintering. https://doi.org/10.1557/s43578-020-00029-w

Probing structural and chemical evolution in $(Al_xGa_{1-x})_2O_3$ using atom probe tomography: A review

Baishakhi Mazumder, Jith Sarker

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Structural-chemical evolution during processing of $(Al_xGa_{1-x})_2O_3$, a novel ultrawide bandgap semiconductor with potential to dominate future power electronics, is analyzed by atom probe tomography (APT). Recent investigations about the structure-chemistry of $(Al_xGa_{1-x})_2O_3$ as a function of alloy composition and doping using machine learning algorithms on APT data demonstrate the outstanding capabilities of APT to study $(Al_xGa_{1-x})_2O_3$. https://doi.org/10.1557/s43578-020-00072-7

Surface passivation of germanium by atomic layer deposited Al_2O_3 nanolayers

Wilhelmus J.H. Berghuis, Jimmy Melskens, Bart Macco, Roel J. Theeuwes, Marcel A. Verheijen, Wilhelmus M.M. Kessels

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Surface passivation is required for germanium (opto)electronic devices. Experiments with atomic layer deposition (ALD) Al_2O_3 thickness (1–44 nm), substrate temperature (50–350°C), and post-deposition anneal (in N_2, up to 600°C) demonstrate that an effective surface recombination velocity as low as 170 cm s^{-1} can be achieved. Studies on the GeO_x interlayer and interface charges reveal a fixed charge density of $-(1.8 \pm 0.5) \times 10^{12}$ cm^{-2}. https://doi.org/10.1557/s43578-020-00052-x

Improving electric thermal stability of polypropylene by chemically linking small amount of hindered phenol groups

Xin Chen, Wenyi Zhu, Q.M. Zhang

Polyproplyene (PP) is a major component of N-95 masks, which would benefit from methods of decontamination. The authors demonstrate that sub-1% additions of hindered phenols, added to PP, can sustain mechanical structures and shapes to near their melting point and concurrently provide additional resistance to electrical degradation. Both of these discoveries are useful for thermal or electrostatic decontamination strategies. https://doi.org/10.1557/s43580-021-00016-1

Synthesis, characterization, and photocatalytic activity of ZnS and Mn-doped ZnS nanostructures

Josian Luciano-Velázquez, Yan Xin, Yi-feng Su, Carla I. Quiles-Vélez, Sebastián A. Cruz-Romero, Gabriel E. Torres-Mejías, Julio Rivera-De Jesús, Sonia J. Bailón-Ruiz

The authors demonstrate that water stable, sub-5 nm zinc sulfide (ZnS) nanoparticles, particularly when manganese is added as a dopant, can act as photocatalysts for the degradation of organic molecules in the presence of light. Sub-1% doping did not change the crystal structure of the nanoparticles, but significantly added a new photoluminescent peak, at 596 nm, not present in the pure ZnS nanoparticles of the same size. https://doi.org/10.1557/s43580-021-00035-y

An investigation into compressive deformation and failure mechanisms in a novel Li-ion solid-state electrolyte

Tofunmi Ogunfunmi, Nnaemeka Ebechidi, Ridwan Ahmed, Oluwaseun Oyewole, John Obayemi, Wole Soboyejo

Determining damage in brittle solid-state battery materials is crucial for developing reliable energy-storage devices. The authors use digital image correlation to measure the effect of adding lithium (Li) iodide (I) to a more standard Li borohydride material, and assess the effect the iodide has on the failure during crimping, demonstrating the I-containing electrolyte fails at lower pressures, but can sustain more deformation prior to failure, useful for fixed strain versus fixed load applications. https://doi.org/10.1557/s43580-021-00014-3

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