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The development of high-temperature irradiation-resistant nickel-based alloys has been receiving much attention due to their potential applications in molten salt reactors (MSRs). Silicon carbide nanoparticle-reinforced nickel-based composites (Ni-SiC_{NP}), with milling time ranged from 8 to 48h, were prepared using mechanical alloying and spark plasma sintering. In addition, unreinforced pure nickel samples were also prepared for comparative purposes. e microstructure of the Ni–SiC_{NP} composites was characterized by TEM and their mechanical properties were investigated by tensile measurements. e TEM results showed well-dispersed SiC_{NP} particles, either within the matrix, between twins or along grain boundaries (GB), as well as the presence of stacking faults and twin structures, characteristics of materials with low stacking fault energy. e tensile test results indicated that the addition of SiC_{NP} can e ectively strengthen the nickel. Furthermore, the helium di usion behavior of such composites and pure nickel under 3 MeV helium ion irradiation at 600°C with ion uence up to 3×10^{20} ions/m^2 has also been studied. e TEM results indicated that the presence of dispersed SiC_{NP} in nickel can inhibit the growth of helium bubbles, thereby mitigate the helium embrittlement and swelling of nickel-based alloys. e theoretical calculation results using the density functional theory (DFT) showed that the helium atoms prefer to di use to the interface between SiC_{NP} and nickel matrix, and thus avoid the grain boundary segregation and also the growth of helium bubbles. is study con rmed the feasibility of dispersing carbides in nickel-based alloys to improve the irradiation-resistant performance of materials.

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Insulators turning into conductors after adding dopants

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Polymetatoluidine (PMT) and Polyaniline (PANI) prepared by McDiarmid method, a er doping with di erent dopants (salts of transition metals like copper, Brown-red complex of copper with 2,9-dimethylphenanthroline [Cu (DMPhen)2] ClO4.) become conductor, which are otherwise insulators. e brown-red complex was dissolved in 1:1 ratio of water and Tetra Hydro Furan (THF). PMT and PANI were separately dissolved in THF and doped with the complex in di erent ratio of 2%, 4% and 6%. Structural characterization of PMT and PANI prepared a er doping of with di erent dopants have been studied at di erent concentration of dopant. FTIR, Scanning Electron Microscopy (SEM) and X-ray Di raction were used for structural characterization of the prepared doped PMT and PANI. ese types of measurements of doped polymetatoluidine and polyaniline systems will be helpful for the development of conducting polymeric materials. DC conductivity also proves the formation of conducting materials a er doping.

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