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Evolution of high performance sustainable magnesium based materials for sustainable planet earth

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Irresponsible use of natural resources such as fossil fuels and environmentally toxic technologies developed over last century has been instrumental for us to enter mass extinction even that is only sixth in last half billion years. The root cause of widespread weather disturbances particularly recorded over last 25 years is primarily attributed to the greenhouse gas emissions with transportation sector, a key player. Attempts have been initiated to reduce the greenhouse gas emissions and one relatively simpler way is through the use of lightweight materials. Magnesium being 35% lighter than currently used aluminum provides a perfect option. Widely available in planet earth coupled with its nutritional characteristics, magnesium is a perfect material that is sustainable and suitable for both engineering and biomedical sectors. In view of the tremendous potential of magnesium based materials, the present talk will focus on the recent developments in the evolution of magnesium based materials including nanocomposites, metastable composites, syntactic composites and magnesium containing high entropy alloys. Insight will be provided on their synthesis and key characteristics primarily focusing on mechanical properties.

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Synthesis of graphene-Fe magnetic nanofluid for enhancement of water thermal conductivity

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In recent years, using nanofluids to increase the heat transfer is gaining much more attention among engineers and researchers. Nanofluids are comprised of a concentration of nanoscale sized particles dispersed in a base fluid. Nanoparticles examples include pure metals, oxides, carbides, and carbon nanotubes. The base fluid can be any material from pure water, ionic liquids, oils, to diluted organic compounds such as ethylene glycol and oleic acid. Magnetic nanofluids also called as ferrofluids, consist of colloidal mixtures of super paramagnetic nanoparticles suspended in a nonmagnetic carrier fluid, constitute a special class of nanofluids exhibiting both magnetic and fluid properties. In these suspensions, also known as smart or functional fluids all features such as fluid flow, particles movement and heat transfer process can be controlled by applying external magnetic fields. In the present work, we proposed to synthesize water base nanofluids consisting of magnetic Graphene-Fe (MGF) nanocomposite and to study the fluid thermal conductivity in presence and in absence of magnetic field. Graphene was prepared by exfoliation method and grapheme-Fe nanocomposite was prepared by co-precipitation of Fe_2O_3 (over graphene) from aqueous salt solution Fe (II) and Fe (III) in alkaline medium. Synthesis of nanofluid has been done by well dispersed of MGF in a certain fluid. The results obtained showed that the dispersion of these nanoparticles in fluid as a magnetic nanoparticle increased the efficiency of nanofluid(when graphene is used alone) and a significant improvment in thermal conductivity has been obtained by addition Fe3O4 to graphene sheets. When the magnetic field is applied, the magnetic dipole moments of the particles align and the particles came in contact with each other and form chains in the direction of the applied magnetic field. When parallel to the direction of heat flow, the magnetic field causes the effective thermal conductivity in the direction of the magnetic field to increase. Characterization techniques like X-ray diffraction (XRD), Scanning electron microscope (SEM), FTIR and Raman shift spectroscopy were used to investigate the morphology and structure of synthesized nanoparticles, while thermal conductivity of nanofluid at different conditions is measured by thermal conductivity meters and temperature thermocouples readings.