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Nanotech 2018: Influence of Mg-Ni-doped ZnFe2O3 incorporation on the structural, morphological and band gap properties of ultra-high-molecular-weight polyethylene- Malik Sajjad Mehmood, Asad Muhammad Azam and Tariq Yasin

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The present study aims at investigating the effect of incorporating nanoscale MgxNixZn-xFe2O3 (where x=0.15) as nanofillers on the physical and chemical stability of ultra-high molecular weight polyethylene (UHMWPE). The effect of adding 1% and 2% (by weight) nanofillers on the physical and chemical properties of UHMWPE/MgxNixZn-xFe2O3 nanocomposites have also been investigated by using FTIR, Raman, and UV-VIS spectroscopy. FTIR data of UHMWPE/MgxNixZn-xFe2O3 nanocomposites reveal that the addition of MgxNixZn-xFe2O3 up to 1% induces significant chemical and physical structural alterations in UHMWPE matrix. However, this behavior is found to reduce on increasing the concentration of nanofillers from 1% to 2%. Raman spectroscopic data show that crystalline contents of UHMWPE remain unaffected by the addition of nanofillers, however; a significant increase in amorphous contents and decrease in an all-trans interphase region is observed. This behavior is attributed to the chain scission reactions due to the addition of MgxNixZn-xFe2O3 followed by compression molding process at high pressure and elevated temperature. Absorption spectroscopy analysis revealed that the incorporation of MgxNixZn-xFe2O3 results in a decrease of energy band gaps from 2.14eV to 2.08eV (for direct transition) and from 1.54eV to 1.38eV (for indirect transition) due to additional subbandgap energy levels which are induced because of MgxNixZn-xFe2O3 incorporation as nanofillers within the PE matrix.

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