Chemically Functionalized Reduced Graphene Oxide as Additives in Polyethylene Composites for Radiation-Shielding Applications

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Developing radiation-shielding materials capable of protecting our astronauts remains a critical challenge in enabling long term space travel or extraterrestrial colonization. Hydrocarbon polymers are often considered in such applications for their relatively light weight and rich H content that is known to block specific types of radiation encountered during space expeditions. Furthermore, as they lack larger heteroatoms, hydrocarbon polymers are more resistant to radiation-induced degradation pathways. One challenge in using purely hydrocarbon polymers is that they generally feature inferior mechanical properties, such as tensile strength and impact toughness, compared to more high-performance polymer systems. In addition, hydrocarbons are generally insulating materials and can therefore statically charge, which can present hazards to astronauts and their equipment. In this work, we seek to address these issues by incorporating chemically modified reduced graphene oxide (MrGO) into high density polyethylene (HDPE) during melt compounding. Films containing different loadings of MrGO are fabricated and the electrical, mechanical, and radiation-shielding properties are characterized to examine the efficacy of these composites for space applications.