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Enhancing the Neutron Shielding Ability of Polyethylene Composites with an Alternating Multi-layered Structure

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Abstract

Neutron radiation is often encountered in a wide range of industries, such as aerospace, healthcare and nuclear power plants. It has been an arduous challenge to shield this neutron radiation to improve equipment safety and protect human health. In order to make an effective neutron shielding material, alternating multi-layered composites (high density polyethylene)/(high density polyethylene/boron nitride), (HDPE/(HDPE/BN)) and (HDPE/BN)/(HDPE/Barium sulfate (BaSO₄)) were fabricated using a multi-layered co-extrusion system. The HDPE/BN layers in the alternating multilayered HDPE/(HDPE/BN) and (HDPE/BN)/(HDPE/BaSO₄) composites had a continuous and layered distribution in their structure, with the BN particles oriented in the extrusion direction. The probability of collision between incident photons and flake-shaped particles is enhanced through alignment of the oriented BN particles. In this way, neutron transmittance noticeably decreased with an increasing number of layers. Compared to traditional polymer-blended materials, the

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