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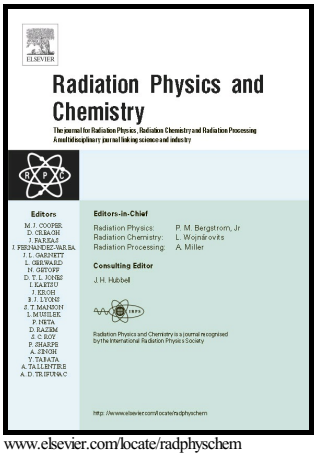

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Hexagonal Boron Nitride and Polydimethylsiloxane: A Ceramic Rubber Composite Material for Neutron Shielding

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Abstract

Flexible nature of the shielding material could be vital for the intervention of radiation accidents/incidents. On the other hand, ceramic rubber composites via incorporation of ceramic material to the polymeric matrix enhances different unique properties. Materials with boron content are effective in thermal neutron absorption, so the composite of silicone rubber and hexagonal boron nitride is a good candidate material for neutron shielding material. In this regard, hexagonal boron nitride with its unique properties could be used for neutron attenuation as the ceramic filler for the rubber matrix. In this study, silicone rubber(polydimethylsiloxane) incorporated with hexagonal boron nitride was vulcanized, and mechanical, thermal and neutron attenuation tests were performed. Attenuation rate (I/I_0) of 60.7% was achieved for the ceramic rubber composite containing 30 wt% hBN with a thickness of 6.9 mm. Silicone rubber with hexagonal boron nitride composite could be a suitable material for shielding purposes thanks to its flexibility and neutron absorption capability.

1. Introduction

Silicone rubber is used in a broad range of industrial applications such as pharmaceuticals, coatings, power network systems, electronics, adhesives, automotives and medical purposes [1-4]. It could resist to the external ultraviolet light, ozone and heat in various extreme environments. In addition, silicone rubber has unusual properties; it is stable, soft, nontoxic and nonflammable[5]. The common type of silicone rubber used is the polydimethylsiloxane (PDMS).

On the other hand, composites of silicone with different fillers has been studied [6-8]. Silicone rubber is one of the important insulation material for the electrical cables in nuclear power plants due to its excellent heat resistance and high resistance for chemical agents [9-10]. Additionally, silicone rubber is applied in spacecraft due to its various characteristics such as

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