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Researchers create new type of composite material for shielding against neutron and gamma radiation

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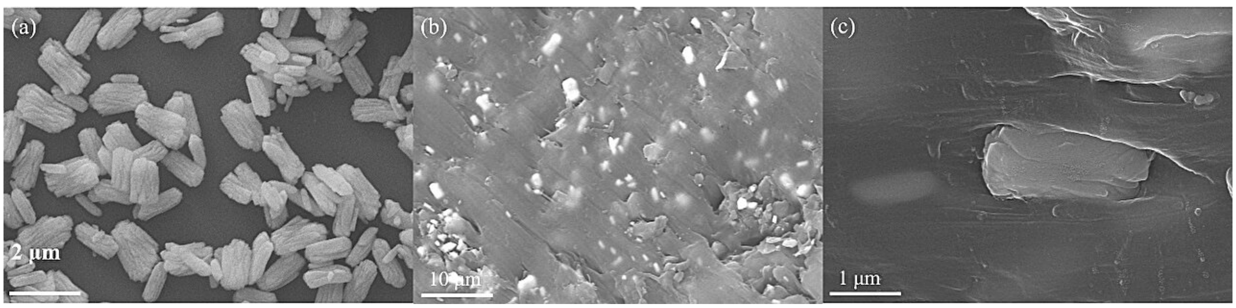


SEM images of Sm_2O_3 micron plate (a), and SEM images of fracture surfaces of Sm_2O_3/B_4C/HDPE composite (b-c). Credit: Huo Zhipeng

Recently, Dr. Huo Zhipeng and his student Lu Yidong from Hefei Institutes of Physical Science of Chinese Academy of Sciences have created a new type of composite material for shielding against neutron and gamma radiation. They used micron plate Sm_2O_3, a type of rare earth-based filler, to reinforce boron-containing polyethylene.

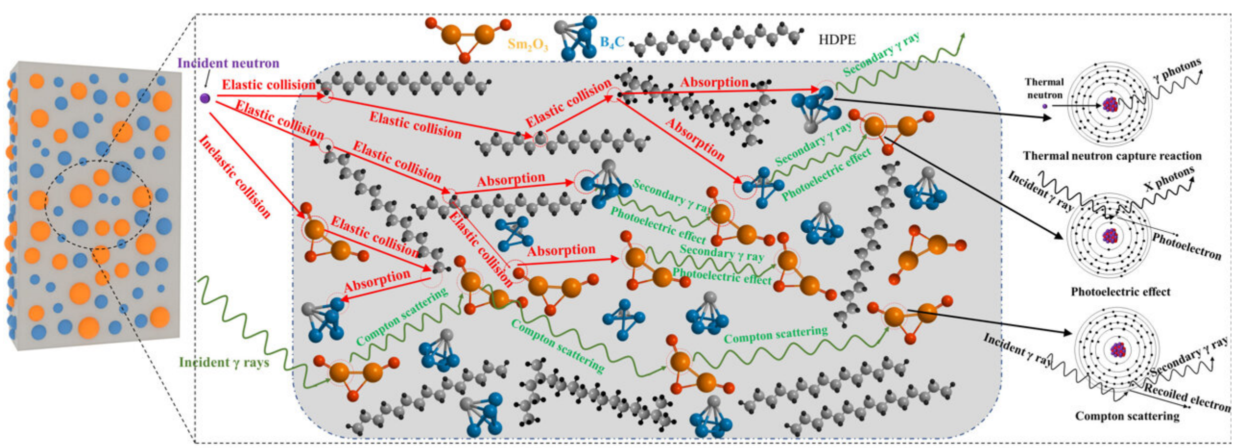
The research results were published on *Composites Science and Technology*.

Radiation protection relies on time, distance, and shielding. High-energy neutrons and gamma rays can harm tissues and genes. Lead-based materials are commonly used for shielding, but they're toxic. Samarium, a rare earth element, is promising for shielding as it absorbs both neutrons and gamma rays.

However, there's a need for more research on how the microstructure of materials affects their shielding properties. Developing rare earth fillers with specific characteristics could lead to better neutron-gamma shielding materials.

In this study, a series of micron plate Sm_2O_3 fillers with different specific surface areas and particle size distributions were synthesized by homogeneous coprecipitation method. They found that adjusting the synthesis process could produce fillers with uniform size and [high surface area](#).

These fillers were then added to boron-containing polyethylene to create composites. The composites showed improved [thermal stability](#), [mechanical strength](#), and radiation shielding properties compared to materials without the fillers.



The mechanism diagram of the composite materials interacting with neutron and gamma rays. Credit: Huo Zhipeng

Tests revealed that the composite material could block 98.7% of neutron radiation from a ^{252}Cf source and 72.1% of gamma radiation from a ^{137}Cs source when the material was 15 cm thick.

This work provides a novel strategy for the development of radiation protection technology from the perspective of materials science.

More information: Zhipeng Huo et al, Sm2O3 micron plates/B4C/HDPE composites containing high specific surface area fillers for neutron and gamma-ray complex radiation shielding, *Composites Science and Technology* (2024). DOI: 10.1016/j.compscitech.2024.110567

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