

Study suggests polymer composite could serve as lighter, non-toxic radiation shielding

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A new study from researchers at North Carolina State University suggests that a material consisting of a polymer compound embedded with bismuth trioxide particles holds tremendous potential for replacing

conventional radiation shielding materials, such as lead.

The [bismuth](#) trioxide compound is lightweight, effective at shielding against ionizing radiation such as [gamma rays](#), and can be manufactured quickly—making it a promising material for use in applications such as [space exploration](#), medical imaging and [radiation therapy](#).

"Traditional radiation shielding materials, like lead, are often expensive, heavy and toxic to human health and the environment," says Ge Yang, an assistant professor of nuclear engineering at NC State and corresponding author of a paper on the work. "This proof-of-concept study shows that a bismuth trioxide compound could serve as effective radiation shielding, while mitigating the drawbacks associated with traditional shielding materials."

In the new study, researchers demonstrated that they could create the compound using a curing method that relies on ultraviolet (UV) light—rather than relying on time-consuming high-temperature techniques.

"Using the UV curing method, we were able to create the compound on the order of minutes at room temperature—which holds potential for the rapid manufacturing of radiation shielding materials," Yang says. "This is an important point because thermal polymerization, a frequently used method for making polymer [compounds](#), often relies on high temperatures and can take hours or even days to complete. The UV curing method is both faster and less expensive."

Using the UV curing method, the researchers created samples of the polymer compound that include as much as 44% bismuth trioxide by weight. The researchers then tested the samples to determine the material's [mechanical properties](#) and whether it could effectively shield against ionizing radiation.

"This is foundational work," Yang says. "We have determined that the compound is effective at shielding gamma rays, is lightweight and is strong. We are working to further optimize this technique to get the best performance from the material.

"We are excited about finding a novel radiation shielding material that works this well, is this light, and can be manufactured this quickly."

The paper, "Gamma [radiation](#) shielding properties of poly (methyl methacrylate) / Bi₂O₃ composites," is published in the journal *Nuclear Engineering and Technology*.

More information: Da Cao et al, Gamma radiation shielding properties of poly (methyl methacrylate) / Bi₂O₃ composites, *Nuclear Engineering and Technology* (2020). [DOI: 10.1016/j.net.2020.04.026](https://doi.org/10.1016/j.net.2020.04.026)

Provided by North Carolina State University

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