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Author: Mrs. Erika Velio
PIKALI, France

Mr. Esteban Décline
ALTEN, France

ADVANCING HABITABILITY PROPERTIES IN SPACE: SHIELDING AGAINST COSMIC RADIATION WITH POLYMER-BASED MATERIALS AND BEYOND

Abstract

As humanity ventures further into space exploration and long-duration missions become more commonplace, the need for robust habitability properties to protect against cosmic radiation becomes increasingly imperative. We propose an innovative approach leveraging polymer-based materials and other advanced technologies to enhance radiation shielding for space habitats and equipment.

Polymer-based materials offer a promising solution due to their lightweight nature, flexibility, and potential for radiation resistance. Through the integration of specially engineered polymers, such as polyethylene and polyimides, into the construction of space habitats and equipment, a significant reduction in radiation exposure can be achieved without compromising structural integrity or adding excessive weight.

Furthermore, we explore complementary strategies, including the use of metal alloys, composites, and advanced shielding technologies, to provide additional layers of protection against cosmic radiation. Metal alloys, such as titanium and tungsten, offer high-density shielding capabilities, while composites reinforced with fibers, such as carbon fiber, provide added strength and durability.

Additionally, the incorporation of innovative shielding techniques, such as magnetic shielding and regenerative shielding materials, presents exciting opportunities to further enhance radiation protection in space environments. Magnetic shielding utilizes electromagnetic fields to deflect charged particles away from inhabited areas, while regenerative shielding materials have the potential to repair radiation-induced damage over time.

By combining the unique properties of polymer-based materials with other advanced shielding technologies, this proposed approach aims to establish a comprehensive framework for enhancing cabin properties in space, thereby safeguarding the health and well-being of astronauts and ensuring the success of future space missions. Through interdisciplinary collaboration and ongoing research efforts, we seek to propel the development of next-generation space habitats and equipment capable of withstanding the rigors of cosmic radiation.