Development Of Galactic Cosmic Radiations Shielding Composite and Hybrid Materials

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Abstract
Space missions face numerous hazards, with radiation being a significant concern. These radiative threats include Galactic Cosmic Rays (GCR), Solar Particle Events (SPE), Low Earth Orbit rays (LEO), and Electromagnetic Interference (EMI) [1]**. Effective shielding against these hazards necessitates the use of materials that are both electrically conductive and hydrogen-dense. However, the constraints of weight in space missions demand the incorporation of high-performance lightweight materials. Development of multifunctional and lightweight materials with superior radiation shielding is investigated through the incorporation of two dimensional highly functional reinforcement like pure Graphene, and hexagonal Boron Nitride into a hydrogen dense matrix like High density Polyethylene (HDPE), Ultrahigh Molecular Weight Polyethylene (UHMWPE) as well as Poly-benzoxazine matrices, which are fabricated through 3D printing or molding techniques** [2] [3]**. Synthesis of high quality Graphene using advanced intercalation and Liquid Exfoliation methods allows for very strong sheets to be formed that can be coated onto matrices as reinforcement along with multifunctional properties like EMI Shielding and sensing.**

References

[1] G. Dietze *et al.*, “ICRP PUBLICATION 123: Assessment of Radiation Exposure of Astronauts in Space,” *Ann. ICRP*, vol. 42, no. 4, pp. 1–339, Aug. 2013, doi: 10.1016/j.icrp.2013.05.004.
[2] P. R. De Oliveira *et al.*, “Novel polyimide-hexagonal boron nitride nanocomposites for synergistic improvement in tribological and radiation shielding properties,” *Tribol. Int.*, vol. 189, p. 108936, Nov. 2023, doi: 10.1016/j.triboint.2023.108936.
[3] T. Blachowicz and A. Ehrmann, “Shielding of Cosmic Radiation by Fibrous Materials,” *Fibers*, vol. 9, no. 10, Art. no. 10, Oct. 2021, doi: 10.3390/fib9100060.
[4] “(PDF) Total charge changing cross sections measurements for ^{12}C ion interactions with Al using CR-39 nuclear track detector.” Accessed: Mar. 10, 2025. [Online]. Available: https://www.researchgate.net/publication/363920953_Total_charge_changing_cross_sections_measurements_for_12C_ion_interactions_with_Al_using_CR-39_nuclear_track_detector

Figures

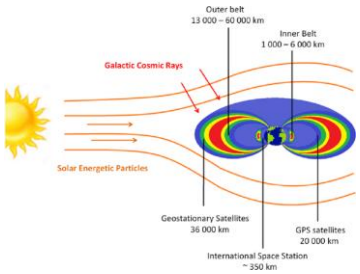

Figure 1: Breakdown of location and intensity of space radiation hazards [4].

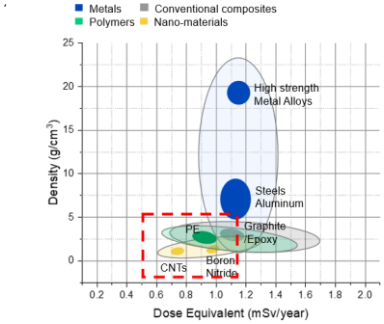

Figure 2: Ashby plot of promising material classes for radiation shielding.