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Experimental Evaluation of BNNT-based Thin Films for Mitigating Single Event Effects in SRAM via Proton Beams

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Semiconductor chips in space are highly vulnerable to Single Event Effects (SEE) caused by high-energy radiation. While conventional bulk shielding is limited by mass and volume, lightweight solutions are essential for space system efficiency. This study investigates thin-film shielding materials utilizing Boron Nitride Nanotubes (BNNTs) and polymer composites. Due to their low atomic mass and high hydrogen-like atomic density, BNNTs are excellent candidates for slowing down incident protons.
We evaluated the radiation shielding performance of BNNT-Parylene C composite films using a Static Random-Access Memory (SRAM) array exposed to 100 MeV proton beam. The results demonstrated that the shielding effectiveness varied based on film thickness and proton energy. Although the reduction in radiation effects was moderate, the findings validate the potential of BNNT-based thin films as lightweight shields against high-energy protons. Future work will focus on optimizing multilayer structures combining hydrogen-rich polymers and higher-density BNNT configurations to enhance shielding performance.

Academic or Professional Status

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