Conventional and Advanced Shielding Materials

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Shielding of instrumentation from energetic neutrons and gamma irradiation requires a substantial spacecraft mass and therefore has been the focus of all designs utilizing fission power plants. Historically, materials such as lithium hydride, beryllium, and boron carbide have been applied to shield neutrons while high density materials such as tungsten provided gamma shielding. This study compares the performance of these "classic" shield materials with newer materials and processes, which were unavailable during the days of SP-100 and earlier programs. These may offer the potential of enhanced performance in future space reactor shields. For example, high temperature hydride ceramics, high-temperature plastics, and carbon nanostructures are being considered for neutron moderation and capture and "engineered" structures capable of carrying out both gamma and neutron shielding are surveyed. The shielding effectiveness of these materials is evaluated and the windows of system operation in temperature and irradiation lifetime are estimated.

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This work was performed in part by the Oak Ridge National Laboratory for the U.S. Department of Energy (DOE) in support of the National Aeronautics and Space Administration (NASA). ORNL is managed for DOE by UT-Battelle, LLC, under contract DE-AC-05-00OR22725. Any opinions expressed in this paper are those of the author(s) and do not necessarily reflect the views of DOE or NASA.