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3D PRINTED SCINTILLATOR FOR RADIATION DETECTION IN SPACE MISSIONS

Abstract

A reliable and prudent radiation risk assessment is of paramount importance in order to guarantee the safety of manned space missions towards Moon and Mars. The astronauts will be exposed to a wide-ranging radiation environment for a long time. The dominant sources of radiation in space are galactic cosmic rays (GCR), solar particle events, and trapped particles in the Earth's magnetic field. GCR consists of around 98Plastic scintillation detectors have been used in nuclear and high energy physics for many decades to detect radiation because of the ease with which are shaped and fabricated. The employment of plastic scintillators, albeit with some limitations, comes with very interesting benefits, such as a very fast response time and the easy and versatile manufacturing. Currently, Additive Manufacturing is one of the most promising methods to produce complex parts from plastics, metals, ceramics, glasses. Three-dimensional printing has evolved into a paradigm-shifting technology in recent years. Therefore, given its versatility, Additive Manufacturing could pave the way to a new generation of scintillation detectors for precision dosimetry both for space and medical applications. This paper describes the development of a novel plastic-based scintillator, being 3D printable and space compliant. The plastic scintillator has been manufactured via 3D printing techniques, using a polymeric matrix polystyrene (PS) properly doped to guarantee a fast response time. The 3D printed scintillator has been characterized in terms of thermo-mechanical properties showing promising performances and a 3D printed sample has been realized and characterized as a proof-of-concept.