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Mechanical characterization of Glass Fiber Reinforced Polymers (GFRP) and resins submitted to ionizing radiations for future accelerator application

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The performance of accelerator magnets strongly relies on electrical and mechanical robustness of their components. With an increase of the energy, future accelerators will have to withstand integral doses around 35 MGy or higher during their lifecycle. Initially developed for the components of the D1 separation dipole magnet, designed and manufactured by KEK and part of the HL-LHC Project, this study was enlarged to characterise a spectrum of Glass Fiber Reinforced Polymers and resins that can be chosen to manufacture main components in superconducting magnets. As a collaboration between CERN, KEK (JP) and QST Takasaki (JP), an irradiation campaign was performed with gamma rays doses going from 10 MGy to 100 MGy. This paper describes the different methodologies applied for mechanical and chemical tests, both at room and cryogenic temperatures. The relevant results and the analysis are presented with the goal to provide a guidance on the choice of specific material or resins in HEP applications.

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