

Research of Proton Irradiation Effect by Ground Based MC-50 Cyclotron for Spacecraft's Shielding of Polyimide Kapton

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Space environment effects on polyimide Kapton[®] is studied for more effective operation of spacecrafts. Polyimide Kapton[®] is widely used for spacecrafts including satellites for the long duration of space mission. Kapton[®] shows the best performance for the thermal control and protection against the strong ultra-violet irradiation among the various organic and synthetic materials. Tensile stress of Kapton[®] film is measured by using self-designed Micro Tester in KRISS(Korea Research Institute of Standards and Science). ITO(Indium Tin Oxide) sputtered and aluminized back Kapton H[®] is exposed to proton irradiation of 27 MeV energy through MC-50 cyclotron at KIRMS(Korea Institute of Radiological & Medical Sciences) for 5, 15, 25, and 50 minutes, which are equivalent to 1, 3, 5, and 10 years exposure time in space, respectively. For 1 and 3 year specimen, the tensile strength becomes higher than untreated material due to the surface enhancement by ion beam effect. For 5 and 10 year specimen, the tensile strength gradually becomes lower than untreated material due to crystalline damage. Therefore, it can be inferred that the mechanical property of Kapton[®] degrades after 5 year operation by solar proton irradiation in space.