Changes of 3d-Printed Plastic Samples Mechanical Properties Caused by 6 MeV Electron Beam Irradiation

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The number of 3D printing technology applications is crucially rising throughout last two decades. One of the prospective applications is high-energy beam shaping. However, to estimate applicability of this approach it is necessary to investigate mechanical properties degradation of 3D printed plastic samples under high radiation dose. Therefore, this work is aimed to study of 3D printed plastic samples mechanical properties, irradiated by the 6 MeV electron beam.

In a frame of work plastic samples made of ABS, PLA and HIPS are produced by fused deposition method with Ultimaker2 printer with modified printhead. For each plastic and two kind of tests, we produce three samples for control group and three for irradiated one. In accordance to the recommendations for determining of the compressive strength (ISO 604:2002) the samples have a cubic shape with a 2 cm long edge. Other samples is $10 \times 20 \times 80 cm^3$ sized accordingly to the recommendations for static bending tests (ISO 178:2010). The irradiation is carried out with the extracted 6 MeV electron beam of TPU microtron with 1.5 kGy dose value. Mechanical properties investigations of irradiated and control samples is carried out on Instron 5985.

Observed results shows that investigated parameters (compressive modulus and bending stress) do not differ for irradiated and control samples made of ABS, PLA and HIPS plastic within measurement error. Thus, it is possible to conclude that 3D printed plastic samples retain their mechanical properties under radiation dose up to 1.5 kGy for all tested materials.

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