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The electron beam propagation through 3D-printed plastic samples with different infill patterns

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Three-dimensional printing has a wide range of applications in science and technology. Fused filament fabrication (FFF) is a commonly used 3D printing technology, which is now being increasingly employed in radiation physics. In FFF, the internal structure of an object is primarily determined by its fill pattern and selected print modes. Therefore, this study aims to examine the interaction between electron beams and 3D-printed plastic samples with various infill patterns.
The 3D-printed objects were produced using FFF with PLA plastic and different infill patterns, including Rectilinear, Grid, Triangles, Stars, Honeycomb, Concentric, Archimedean Chords, Gyroid, and Hilbert Curve. Infill densities of 80% and 90% were utilized. Tomographic methods were applied to analyze the resulting samples. The study provides tomograms of the internal structure for each infill pattern. It was observed that Rectilinear and Grid patterns produced the most homogeneous samples.
Additionally, GafChromic EBT3 film was used to measure the doses behind the plastic samples when exposed to 6 MeV electron beams. It was demonstrated that for 3D-printed plastic samples with different infill patterns for the same infill density, the irradiation dose varied within the error range of the detector.
The findings of this study contribute to understanding of the propagation of electron beams through 3D-printed plastic samples with complex internal structures.
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