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The influence of layer orientation on the mechanical properties of 3D printed models

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The objective of this study was to conduct mechanical tests on 3D core models [1] manufactured using 3D printing with the photopolymer method, specifically SLA (stereolithography apparatus). The tests were performed using the uniaxial compression method. The novelty of this research lies in the manufacturing technique of the samples, with printing conducted in different layer directions, vertical, horizontal, and at angles of 30 and 60 degrees. This variation in layer directions was employed to investigate the influence of layer orientation on the mechanical properties of the material. Based on the test results, the relationship between axial displacement and stress was established for each sample, enabling the determination of the elastic modulus for each variant. It was found that samples with vertically oriented layers exhibited greater elasticity, with an elastic modulus of 13.02 MPa. Conversely, samples with horizontally oriented layers showed the lowest elasticity. This phenomenon is attributed to the development of tensile stresses within the model's thickness for samples with inclined or horizontal layers, subsequently leading to layer slippage. The identified patterns and findings have been utilized to simulate the impact of deformation on the conductivity [2-3] of 3D printed core models. The results of this study contribute to understanding the mechanical behavior of 3D printed materials and inform the modeling of their conductive properties in deformation scenarios.

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