



## » Multi-Material Digital Light Processing (DLP)-Based 3D Printing

PROJECT ID: C1-18

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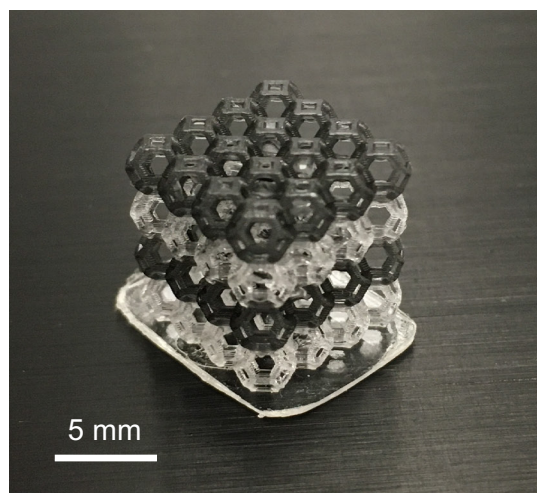
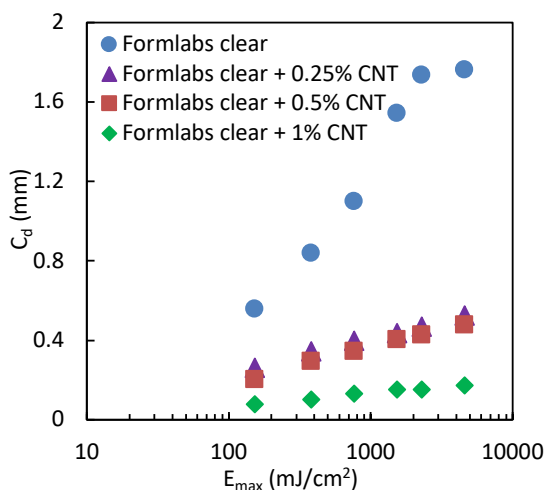
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Additive manufacturing, or 3D printing, has become a powerful technique for fabricating complex 3D micro-architectures for a wide variety of applications, such as tissue engineering, soft robotics, and metamaterials with unusual physical properties. There is a strong and growing demand from industry for high-throughput, high-resolution, and low-cost 3D printing methods for printing polymers containing fillers and structures with multiple materials on the same printing platform. Digital light processing (DLP) technique shows some promise in multi-material and polymer composite printing. However, incorporation of fillers in the photopolymer resin also interferes with the crosslinking process, and 3D printing of multi-material structures containing fillers has yet to be demonstrated. In this work, we have studied the technical feasibility of fabricating multi-material structures containing carbon nanotubes (CNT). A DLP 3D printer capable of multi-material printing has been specially designed and built for this project. The printer was equipped with two resin dispensers and an air jet that allowed removal of uncured photopolymer resins for fast material switching after printing each layer. For determining the optimal UV-exposure parameters, cure depth measurements were carried out to obtain the working curves for neat resins and resins filled with different amounts of CNT. Two different types of CNTs and two different resins were studied. One CNT type exhibited better dispersion characteristics and has been used to create multi-material lattice structures successfully.



(Left) Working curves of Formlabs Clear resin filled with different amounts of carbon nanotube (CNT), (Right) A sample multi-material structure printed using the custom-built DLP printer in this study. The black layers contain 0.25% (w/w) CNT dispersed in Formlabs Clear resin.