3D Printing of Hierarchical Porous Glassy Carbon

Hua, Howard (School: Wheeler High School)

Porous carbon materials are a class of biocompatible and chemically stable solids which offer high thermal conductivity and good electrical conductivity at a low density. These substances are found in a variety applications such as an absorbent, a catalyst support, a filter, an electrode, or a supercapacitor. Porous carbon materials with variable pore sizes and a customizable architecture are highly desirable because of their ability to be manufactured as a single part reduces cost and increases packing efficiency within tight or abnormally shaped structures. Herein, I tested digital light processing printing of a high-performance, high resolution 3D porous glassy carbon architecture for energy storage applications. A composite ink containing phenolic resin, photocurable acrylate and bio-based cellulose nanocrystals was developed. Following printing, a post-print thermal cure process and subsequent pyrolysis formed a strong yet lightweight carbon composite. This model supercapacitor was then charged and the amount of energy it stored was measured. Keywords: 3D printing, porous carbon, digital light processing, supercapacitor.