

View Abstract

ABSTRACT SYMPOSIUM NAME: 3D Printing-enabled Polymeric Composites and Hybrid Systems

ABSTRACT SYMPOSIUM PROGRAM AREA NAME: PMSE

CONTROL ID: 3652234

PRESENTATION TYPE: Oral Preferred : Consider for Sci-Mix

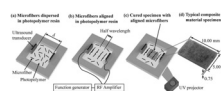
TITLE: Fabricating polymer-matrix composite materials with aligned microfibers using ultrasound directed self-assembly and stereolithography

AUTHORS (FIRST NAME, LAST NAME): [Karl Niendorf](#)¹, Bart Raeymaekers¹

INSTITUTIONS (ALL): 1. Mechanical Engineering, University of Utah, SALT LAKE CITY, UT, United States.

ABSTRACT BODY:

Abstract: Fabricating polymer-matrix composite materials with microfibers aligned along a user-specified direction is important to obtain specific material properties, such as anisotropic electrical and thermal conductivity and improved mechanical strength. We quantify macro- and microscale alignment of microfibers embedded in photopolymer resin, 3D-printed using ultrasound directed self-assembly (DSA) and stereolithography, as a function of three dimensionless input parameters: microfiber weight fraction, dimensionless ultrasound transducer input power, and dimensionless ultrasound transducer separation distance. We use regression analysis to determine microfiber alignment as a function of the fabrication process parameters. Microscale alignment is primarily determined by microfiber weight fraction, whereas macroscale alignment is a function of microfiber weight fraction, dimensionless ultrasound transducer separation distance, and dimensionless ultrasound transducer input power. Relating microfiber alignment to the fabrication process parameters is a crucial step towards 3D-printing composite materials with specific anisotropic material properties.



(a) Reservoir that contains photopolymer resin with dispersed microfibers. (b) Ultrasound transducers create a standing ultrasound wave in the reservoir, driving the microfibers to the nodes of the wave. (c) UV exposure cures the photopolymer resin and fixates the aligned microfibers in place. (d) Picture of a typical composite material specimen resulting from this 3D-printing process, showing the aligned microfibers as dark lines within the light-colored photopolymer resin.

