

Project Title: Microvascular Networks for Electrically Adaptive Composite Materials

Advisors: Anthony Griffin (4th year PhD student in MatSE),
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Project Description:

Recently developed microvascular polymers and composites have been used to achieve autonomous material functions such as self-healing and temperature-regulation. These materials also show great promise in the emerging area of reconfigurable electronic devices. The movement of a liquid metal in microvascular materials has been shown to alter electromagnetic properties and act as electronic devices (Fig. 1). Our project seeks to develop electrically switchable and thermally regulated composites through incorporation of 3D printed vascular networks. These networks will utilize a novel non-wetting coating, which is under development, in order to improve flow of the liquid metal as well. As an undergraduate researcher you will assist in the design, fabrication, and evaluation of 3D printed microvascular networks, non-wetting coatings, and fiber reinforced composite materials. Your objectives will be to (a) assist in design and fabrication of 3D printed vascular structures, (b) fabricate advanced fiber-reinforced composites, and (c) evaluate the electrical switching capabilities of liquid metal in these networks at various conditions.

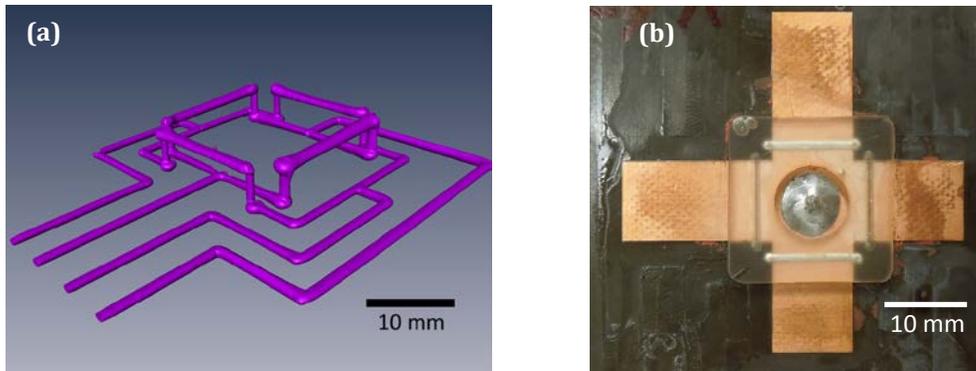


Figure 1. (a) MicroCT image of a 3D printed vascular structure to achieve high power signal alteration in an antenna. (b) Front of the antenna showing two of four channels filled with liquid metal. The channels are formed at the interface of a dielectric composite and transparent structural polymer layer.

Student background and expected research activities:

We are seeking an enthusiastic individual, who is interested in *adaptive electronics*, *engineered surface coatings*, and *composite materials*. Experience in the laboratory is preferred, but not mandatory. The student should be capable of operating equipment for fabrication, be familiar with 3D printing techniques, familiar with fundamental electrical concepts and basic circuits, and possess strong communication skills. Primary duties include hands on work in the lab with sample fabrication, thermal and electrical characterization of samples, and data processing.

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