

**Project Title:** Fabrication of vascular transpiration autonomic cooling composites

**Advisor:** Polette Centellas (PhD student in AE), Prof. Scott R. White (AE)

**Project Description:**

Polymer matrix composites (PMC) are used across various industries and temperature conditions, but are susceptible to structural performance degradation when heated beyond their glass transition temperatures ( $T_g$ ). Our group has shown that cooling a PMC via internal, microvascular channels will retain its mechanical performance even under long exposure to heat. Currently, we are designing microvascular composites that will cool *autonomously* in response to an applied heat flux. These specimens are inspired by leaf biology and self-cool via evaporation of the coolant through its porous layer (i.e. transpiration) (see Fig. 1). As an undergraduate research assistant, your project will be to fabricate these composites with various complex, branched internal networks. As part of the fabrication method, you will model the design using AutoCAD software then fabricate it using laser cutting. The goal is to develop a composite and network design that performs (cools) continuously for long times under applied heat.

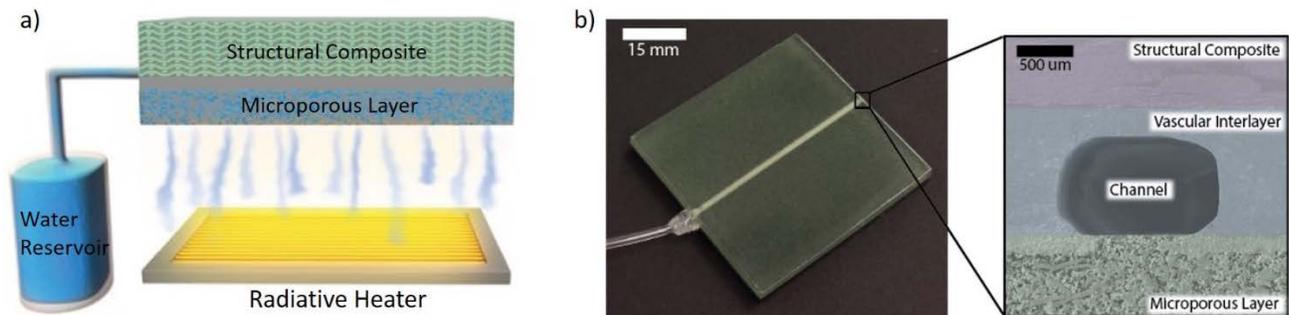


Figure 1: a) Schematic of experimental set-up. Water travels from the reservoir through the specimen's internal vascular channel via capillary pressure and evaporates through the microporous layer facing the heater. b) Specimen with close-up of the through-the-thickness composition. Vascular channel is within the interlayer, which joins the PMC and porous layer. Note: figure adapted from Coppola<sup>1</sup>.

**Student background and expected research activities:**

We are seeking a driven, enthusiastic student who is interested in *smart materials* and *composite manufacturing* with basic skills in AutoCAD. Hands-on experience in composites manufacturing is desired, but not mandatory. The student should be able to operate manufacturing equipment, follow procedures in a precise manner, and possess strong communication skills.

**Points of Contact:**

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1. Coppola, A. (2015). UIUC Dissertation.