MULTIMODAL HEAT TRANSFER TO SHAPE MEMORY POLYMER

USING LASER INDUCED GRAPHENE

A Master's Thesis Defense in Mechanical Engineering

California Polytechnic State University, San Luis Obispo

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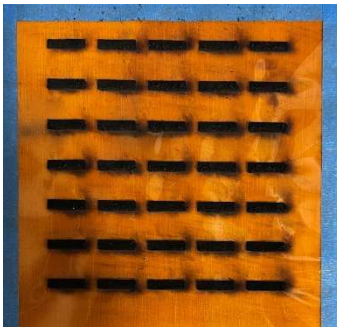

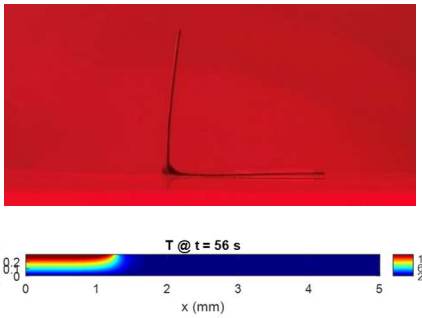

Shape memory polymers (SMPs) can undergo programmed shape transformations when heated above their glass transition temperature (T_g), enabling actuation through stimuli such as infrared (IR) radiation and Joule heating. These materials are promising for deployable systems and soft robotics due to their lightweight structure and elimination of traditional mechanical components. While IR-based actuation is simple and low-cost, it lacks precision in uncontrolled environments. Joule heating offers improved control but is often limited by conductive ink properties such as thickness, stiffness, or poor adhesion. This work introduces a novel method for multimodal SMP actuation using laser-induced graphene (LIG) transferred from polyimide to polystyrene substrates. The resulting conductive patterns enable both IR absorption and resistive heating, providing a reliable and scalable approach to SMP activation. Heat transfer via radiation and convection was also computationally modeled in MATLAB to support experimental findings.

Tuesday June 3rd, 2025, 10:00AM. Building 13 Room 124B

Zoom Meeting ID: 233 808 3377 | https://calpoly.zoom.us/j/2338083377