Mechanical & Industrial Engineering
UNIVERSITY OF TORONTO

MIE498H1: Research Thesis 2024-2025

Supervisor	Patrick Lee
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Number of Positions	1
Open to	Mechanical Engineering Students
Term Offered	Full-Year (Y)
Research Area	Materials
Research Topic	Subcutaneous Vein Detection and Mapping for Home Hemodialysis Self-cannulation

Project Description

Although home hemodialysis (HHD) benefits renal patients including improving their lives' quality, selfcannulation is currently a limiting and challenging step in their treatment. Some works have been performed to help patients locate their veins, such as surgical skin markers, near-infrared or ultrasound mapping; however, a more practical and easy-to-use solution without the need for external and expensive devices or permanent markings on the body has still remained unsolved. In this study, we aim to solve this problem by developing an epidermal film/patch fabricated from flexible and biocompatible polymer such as polydimethylsiloxane (PDMS) and thermochromic liquid crystals (TLCs) to visualize veins. The ability of TLCs to change color when adjacent to temperature difference of veins from the skin have made them suitable materials in the vein-visualizer epidermal patch. The patch simply contains a three-layered structure consisting of the thin PDMS substrate, embedded TLCs and the PDMS film as the encapsulant of the biomatrix composite on the top-layer. A customized formulation of TLCs is required in order to specifically be employed in this patch in the desired temperature operating of the forearm skin and vein temperature difference, 33-37 °C, and 0.5-1.2 °C, respectively. Spin coating and blade coating are the main processes for the fabrication of this polymer-based TLC-embedded matrix patch.

Additional Information	N/A
Application Instructions	Please submit CV, unofficial transcript, to Prof. Patrick Lee (patricklee@mie.utoronto.ca)