# Mechanical Engineering Thesis Defense

## Ventilated Capsules for Sweat Evaporation Rate Measurement

School for Engineering of Matter, Transport and Energy

Rajesh Ramesh

**Advisor:** Konrad Rykaczewski

## Abstract

Sweat evaporation is fundamental to human thermoregulation, yet our knowledge of the microscale sweat droplet evaporation dynamics is very limited. To study sweat droplet evaporation, a reliable way to measure sweat evaporation rate from skin and simultaneously image the droplet dynamics through midwave infrared thermography (MWIR) or optical coherence tomography (OCT) is required. Ventilated capsule is a common device employed for measuring sweat evaporation rates in physiological studies. However, existing designs of ventilated capsules with cylindrical flow chambers create unrealistic flow conditions that include flow separation and swirling. To address this problem, this thesis introduces a ventilated capsule with rectangular sweat evaporation area preceded by a diffuser section with geometry based on wind tunnel design guidelines. To allow for OCT or MWIR imaging, a provision to install an acrylic or a sapphire window directly over the exposed skin surface being measured is incorporated in the design. In addition to the capsule, a simplified artificial sweating surface that can supply water in a filmwise, single or multiple droplet form was developed. The performance of the capsule is demonstrated using the artificial sweating surface along with example MWIR imaging.

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