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Sensing technology provides quantitative characterization of blood flow, hydration, perfusion, skin temperature, and thermal transport properties.

Thermal transport measurements are traditionally used to characterize materials. But Madhvapathy et al. described how thermal sensing can be applied to skin physiology for clinical applications.

Such sensors would offer quantitative insight into skin health by noninvasively measuring the thermal properties of the different layers of skin. They can be easily integrated to develop devices with various, multimodal measurement capabilities, such as macrovascular blood flow, perfusion, hydration, and skin/core temperature. And the technology would be less bulky and expensive than what is currently used.

“Dermatological diseases are often diagnosed in a clinic by visual inspection,” said author John Rogers. “However, different skin diseases often have similar visual appearances, making them difficult to distinguish. A quantitative characterization tool like thermal transport measurements would aid in more accurate diagnosis.”

The sensors operate in two modes: passive and active. The former monitors skin temperature, while the latter applies a small amount of heat to the skin surface, then observes the spread of that heat over time. The active mode detects the skin’s thermal transport properties, such as thermal conductivity, thermal diffusivity, and heat capacity.

“Thermal sensing offers versatility in measurement parameters, measurement techniques, design guidelines, and analysis approaches, enabling extraction of a host of important physiological parameters at targeted depths beneath the skin surface,” said Rogers.

The team hopes their work serves as a guide for the design of future sensor devices, and that it inspires further study in noninvasive thermal sensing applied to skin physiology.

Source: “Advanced thermal sensing techniques for characterizing the physical properties of skin,” by Surabhi R. Madhvapathy, Hany M. Arafa, Manish Patel, Joshua Winograd, Jessy Kong, Jason Zhu, Shuai Xu, and John A. Rogers, *Applied Physics Reviews* (2022). The article can be accessed at https://doi.org/10.1063/5.0095157.

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