

Abstract Submitted
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Fully Wickless Vapor Chamber - Thermal Diode¹ GEORGE DAMOULAKIS, CONSTANTINE M. MEGARIDIS, Univ of Illinois - Chicago — In this study, a vapor chamber (VC) - thermal diode (TD) apparatus, with wickless and wettability-patterned components is fabricated and tested. This device is the first truly-wickless system of its kind, and could be implemented as a heat transfer module in a cooling system for electronics. Our approach takes advantage of the water's phase-changing property, within a closed loop composed of two wickless wettability-patterned components (evaporator and condenser). The two plates have different wettability patterns, each specially designed to transform a rectangular copper plate to a functional component of a VC. The working medium evaporates from the hot central point of the evaporator and condenses on the cooled condenser. The wettability pattern of the condenser allows spatially controlled dropwise and film-wise condensation and offers an optimal way to move the condensate through wedge tracks utilizing capillary forces, while the evaporator's pattern enables the accumulation and the transport of the returning condensate liquid to the central portion where evaporation is strongest. If the condenser experiences a higher temperature than the evaporator, the wettability patterns no longer function harmoniously with each other. Thus, the device acts as a TD, preventing the heat flow in the opposite of the preferred direction.

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