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Influence of Substrate Conductivity on Circulation Reversal in Evaporating Drops W.D. RISTENPART, P.G. KIM, C. DOMINGUES, J. WAN, H.A. STONE, School of Engineering and Applied Sciences, Harvard University — Non-uniform evaporation from sessile droplets induces radial convection within the drop, which produces the well-known 'coffee ring' effect. The evaporation also induces a gradient in temperature and consequently a gradient in surface tension, generating a Marangoni flow. Here we investigate theoretically and experimentally the thermal Marangoni flow and establish criteria to gauge its influence. An asymptotic analysis indicates that the direction of the flow depends on the relative thermal conductivities of the substrate and liquid, $k_R \equiv k_S/k_L$, reversing direction at a critical contact angle over the range $1.45 < k_R < 2$. We corroborate the theory experimentally and demonstrate that the Marangoni flow can significantly influence the resulting patterns of particle deposition.

> W.D. Ristenpart School of Engineering & Applied Sciences, Harvard University

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