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Bénard-Marangoni instability driven by moisture absorption SANGWOO SHIN, IAN JACOBI, JASON WEXLER, HOWARD STONE, Department of Mechanical and Aerospace Engineering, Princeton University — We describe experiments that exhibit Bénard-Marangoni convection cells in hygroscopic fluids without external heating. Bénard-Marangoni convection cells are classically driven by a heat source beneath a thin layer of fluid with a free-surface. External heating provides a reservoir of hot fluid to amplify the free-surface temperature perturbations which drive Marangoni flow; without the heat source, the system naturally damps the temperature fluctuations and stabilizes itself. By drawing water vapor from ambient air, certain hygroscopic fluids can generate their own internal heat source by exploiting an exothermic enthalpy of solution with water. We verify the origin of the instability by using different hygroscopic fluids. The dynamics of this unusual instability are measured as a function of the fluid and air properties of the system, and a mathematical model is developed to rationalize the results quantitatively.

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