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Convection in binary fluids with phase change: solutocapillarity, thermocapillarity and buoyancy[1] YAOFA LI, MINAMI YODA, Georgia Institute of Technology — Evaporative cooling is of interest in thermal management applications. In most cases, thermocapillary stresses drive liquid coolant away from hot regions, adversely affecting performance. Volatile binary fluids can, however, be tailored with *solutocapillary* stresses that drive liquid instead towards hot regions. Although such binary-fluid coolants could improve the cooling performance of devices such as heat pipes, convection in a binary fluid subject to phase change, especially in a confined geometry in the (near-)absence of noncondensables as is the case in heat pipes, is poorly understood. Capillary-buoyancy convection in liquid layers (with depths of a few mm) driven by temperature differences as great as 10 °C over a horizontal distance of 4.9 cm was therefore studied with particle-image velocimetry (PIV). The flow of water-methanol mixtures (with methanol fractions as great as 60%) was studied under conditions where the vapor space was filled with ambient air, and a mixture of water and methanol vapor with a small amount of air. The results show that varying the amount of air in the vapor space has a marked effect on the flow in the liquid layer.

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