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The effect of noncondensables on the stability of buoyancy-thermocapillary convection[1] YAOFA LI, ROMAN GRIGORIEV, MINAMI YODA, Georgia Institute of Technology — Buoyancy-thermocapillary convection is a well-known problem that is also of interest in evaporative cooling. Our fundamental understanding of convection and transport in the presence of phase change remains limited, however. Pathline visualizations and PIV were used to study convection in a confined layer of a pure volatile 0.65 cSt silicone oil driven by a horizontal temperature gradient at Marangoni numbers $Ma < 10^3$ and Bond numbers $Bo_D = O(1)$ below a sealed vapor space containing noncondensables (*i.e.*, air) at concentrations $c_\mathrm{a} = 11$ mol% $- 96$%. At $c_\mathrm{a} = 96$% (*i.e.*, ambient conditions), the results are in qualitative agreement with previous studies and a new linear stability analysis, with transitions from steady unicellular to partial multicellular to steady multicellular flow, then to oscillatory multicellular (OMC) flow as Ma increases. In the OMC state, the cells oscillate near the heated end, but travel instead towards the cooled end. The results show that decreasing c_a has a marked effect on the flow stability, increasing the critical Ma for transition between different flow states. Indeed, only steady unicellular and partial multicellular flow states are observed at $c_\mathrm{a} = 11$% for these Ma.

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