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Hindered thermally driven migration of a drop on a chemically patterned solid wall. GUANGPU ZHU, China University of Petroleum (East China), JIACAI LU, XIANYANG CHEN, Johns Hopkins University, JUN YAO, China University of Petroleum (East China), GRETAR TRYGGVASON, Johns Hopkins University, RESEARCH CENTER OF MULTIPHASE FLOW IN POROUS MEDIA TEAM, COMPUTATIONAL MULTIPHASE FLOW GROUP TEAM — A drop in a thermal gradient migrates to the hot side since surface tension is usually a decreasing function of temperature. If the drop is attached to a surface with a temperature gradient, the motion is more complicated. The drop either moves to the hot side or cold side, depending on the contact angle and viscosity ratio. If the surface with a temperature gradient is patterned, the wettability is different for different patches and here we show, using numerical simulations of two-dimensional flows, that is certain cases the drop can be brought to a halt, even if the drop moves in one direction when it occupies one patch only. Two quantities are defined to judge whether the patterned surface can hinder the thermally driven migration of a drop, namely, defect strength and minimum defect strength. The patterned surface can hinder the drop migration only when the defect strength is larger than the minimum defect strength. The minimum defect strength increases with the Marangoni number but decreases with the viscosity ratio. These results are summarized in a phase diagram. The force analysis is conducted to explain the above results.

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