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Surface wetting and bubble dynamics of dielectric fluids boiling in high electric fields[1] NAVDEEP DHILLON, CHRISTOPHER LOVE, SEYED REZA MAHMOUDI, KRIPA VARANASI, Massachusetts Inst of Tech-MIT — We present results of an experimental study on the effect of high electric fields on the nature of bubble formation and departure in nucleate pool boiling of dielectric fluids. Despite some past studies looking at the application of electric fields to enhance boiling performance, the exact mechanism of interaction of these fields with the fluid/surface is not well understood. In this study, we employed high-speed optical and infrared (IR) imaging to observe changes in wetting behavior of the fluid on the solid surface and the mode of bubble formation and departure under applied electric fields. The experimental results point towards a liquid film stabilization effect of the applied electric field on the boiling surface. Both the bubble departure size and surface dry spot dynamics is visibly altered under the effect of the electric field. These effects can be attributed to the development of surface charges on the bubble microlayer adjacent to the liquid-vapor contact line, which affect the liquid receding and surface rewetting mechanisms.

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