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Flow Patterns During Convective Boiling in Microchannels

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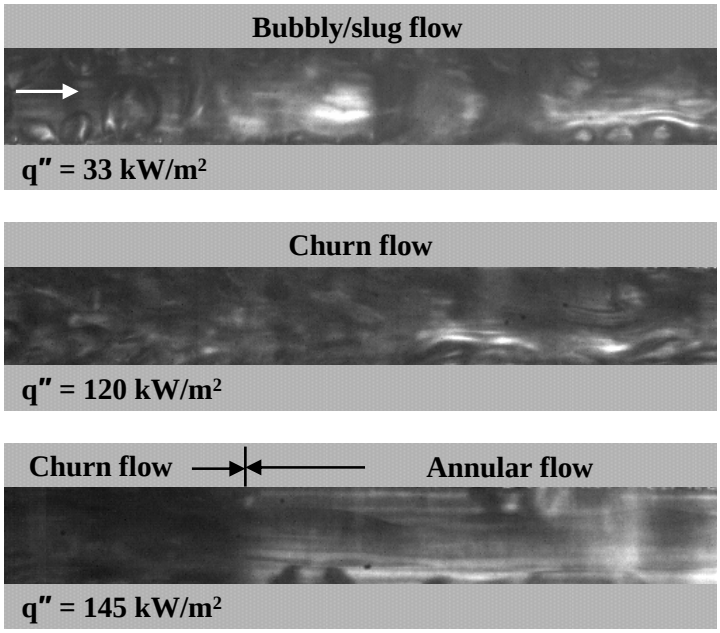
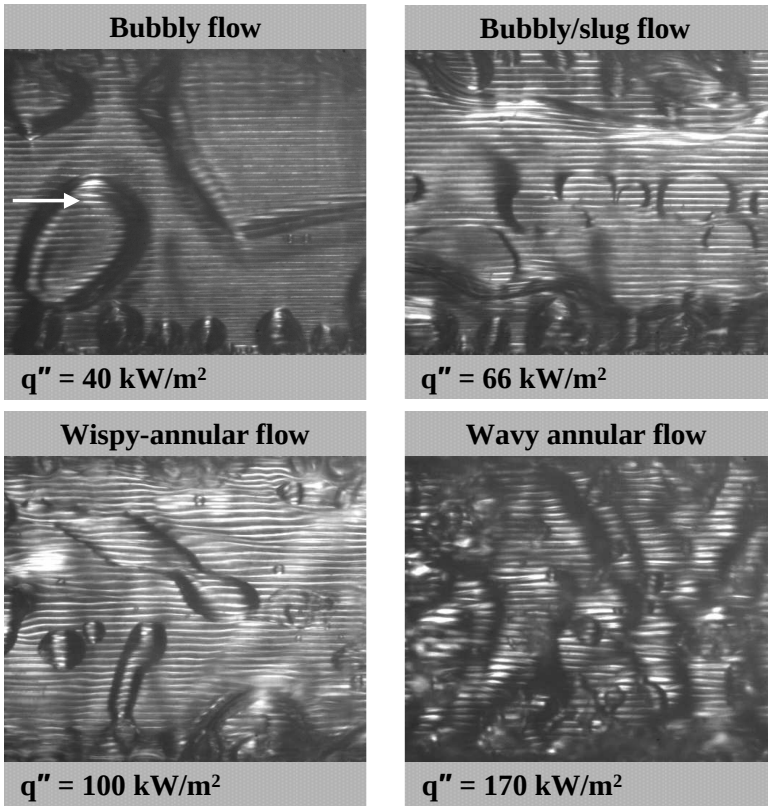
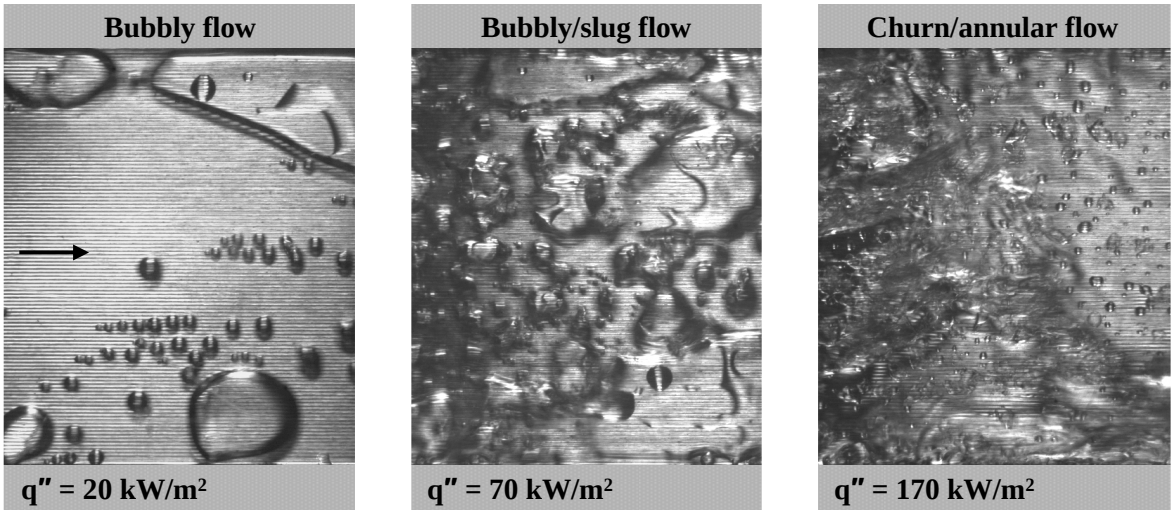
Flow patterns in 400 μm x 400 μm microchannels (8000 fps)



Flow patterns in 2200 μm x 400 μm microchannels (6000 fps)



Flow patterns in 5850 μm x 400 μm microchannels (2000-4000 fps)



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To develop a flow regime map for convective boiling in microchannels and to propose flow pattern-based models to predict the corresponding heat transfer coefficients, a thorough understanding of the existing flow patterns and their transitions is necessary. In the present study, high-speed photography is employed to observe the flow patterns in flow boiling of a dielectric liquid, FC-77, in parallel silicon microchannels of depth 400 μm and widths ranging from 100 to 5850 μm. In each test, liquid mass flux and inlet subcooling are fixed at 250 kg/m^{2}s and 5℃, respectively, while the heat flux to the bottom of the heat sink is increased form zero to a value near the critical heat flux. Temperature and pressure are measured at several locations. A high-speed digital video camera is used to observe boiling patterns at frame rates ranging from 2000 to 24000 frames per second (fps). The images presented show a top view of the horizontal microchannels, at a location along the heat sink centerline and near the flow exit.