Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Heat Transfer Enhancement in Forced Convective Boiling in Microchannels by Periodic Electrospun Nanofiber Coatings ALEXANDER YARIN, University of Illinois at Chicago, MARTIN FREYSTEIN, FELIX KOLBERG, Technische Universität Darmstadt, SUMIT SINHA-RAY, RAKESH SAHU, University of Illinois at Chicago, LUCAS SPIEGEL, TATIANA GAMBARYAN-ROISMAN, PETER STEPHAN, Technische Universität Darmstadt — To enhance heat transfer in forced convective boiling the microchannel bottom was amended by a nano-texture - periodic rectangular mats of electrospun polymer nanofibers. The fibers were $\sim$ 300-500 nm in diameter and the mat thicknesses were about 6-15 μm. The test fluid was FC-72 and the flow in microchannels contained trains of Taylor bubbles. The role of the nanofibers was to retain the warm microchannel bottom wet, to prevent dry-out and thus to enhance the heat removal rate. In the present experiments the time-average heat flux and heat transfer coefficient at the nanofiber-coated domains were found to be 1.5-2 times higher than those at the uncoated ones. Accordingly, a significant decrease (by 5-8 K) in the superheat was observed at the same *Re* of 387 and power supply of 36.1 kW/m2. At a higher *Re* of 432 and lower power supply of 28.1 kW/m2 similar trends in the heat removal rate and surface superheat were found. The significant enhancement of the heat transfer results from the fact that nanofiber mats facilitate wetting of surface under passing Taylor bubbles, thus delaying formation of vapor flow at the channel bottom. The interstices of the nanofiber mat act as the nucleation sites facilitating formation of tiny bubbles, which eventually results in a higher heat removal rate from the surface at a reduced superheat.

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Date submitted: 12 Nov 2014 Electronic form version 1.4