Performance Characterization of High-pressure Electrohydrodynamic Conduction Pump

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***Abstract*— Efficient pumping and control of heat transfer fluid is a critical requirement in heat transfer equipment such as heat exchangers and heat pipes. While mechanical pumping may be adequate, certain applications demand high heat removal and low power consumption. In this respect, electrically driven pumps are an appropriate alternative to traditional mechanical pumps. Electrohydrodynamic (EHD) pumps are examples of electrically driven pumps that have been widely studied for use in various applications and also to explore the interaction between flow and electrical fields. In electrohydrodynamic conduction pumping of a dielectric liquid, the application of an electric field leads to dissociation and recombination of neutral electrolytic species. The Coulomb force is responsible for distributing dissociated ions near the electrodes where they form heterocharge layers. The movement of heterocharge layers towards the ! electrodes causes bulk fluid motion. In this way, pumping can be achieved without the use of moving parts which results in simple but highly reliable pump designs. This paper presents the results of experiments with a perforated-plate/ring electrode configuration with electrode spacing of 2.5 mm. Pump performance curves show that significant pressure generation of up to 50 kPa was achieved with refrigerant HCFC-123 as the working fluid. Preliminary calculations with latent heat properties indicate that very high heat transport rates are possible with power consumption that is two orders of magnitude lower.**