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Thermal Dielectrophoretic (T-DEP) Force HOWARD HU, BARUKYAH SHARARENKO, HAIM BAU, University of Pennsylvania — When subjected to a non-uniform electric field, a dielectric particle in a dielectric medium experiences a dielectrophoretic (DEP) force. For some applications in microfluidic systems, thermal effects due to Joule heating are quite important. In this study, we examine the additional dielectrophoretic force due to the thermal effect, which we termed as thermal dielectrophoretic (T-DEP) force. A thermal gradient may be established in the fluid due to Joule heating, which leads to the spatial variations in conductivity and permittivity of the fluid. With the gradients in the conductivity and permittivity, an electric field (even a uniform field) will induce electric forces in the fluid (and in the particle), and cause a flow (electrothermal flow). We have derived an expression for the net thermal dielectrophoretic (T-DEP) force acting on a particle suspended in a medium with a temperature gradient. This extra T-DEP force has never been discussed in literature, could be important in predicting the particle trajectories in such flow systems, and explain the discrepancy observed between the theoretical prediction and experimental measurements.

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