Nanoscale Brownian motion-based thermometry in near wall region

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In nanoparticle image velocimetry (nPIV), evanescent wave illumination is used to measure near-wall velocity fields with an out-of-plane resolution of less than 200nm. Similar methodology can be extended for temperature measurements using Brownian motion characteristics of the sub-micron tracer particles in this region. Temperature change affects Brownian motion of tracer particles through a change in Brownian diffusion coefficient and a change in viscosity. The present study tries to numerically investigate the possibilities of utilizing this effect in near-wall thermometry. Synthetic nPIV images of the illuminated particle tracer of 100nm diameter are initially generated. The spatial distribution of the particles takes into account near wall forces such as buoyancy, electrostatic repulsion and Van Der Waals attraction, in addition to the hindered Brownian motion. Validation studies are carried out using stationary liquids at constant temperatures. It is believed that this observation would help in explaining the anomalous heat transfer characteristics of nanofluids.