EFFECT OF INSTABILITY ON THE CRITICAL BEHAVIOR OF HEAT CAPACITY FOR ETHANOL + DIAMOND NANOFLUID

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A deeper understanding of the thermodynamic properties of nanofluids can leads to marked improvements in their industrial applications (environmental, mechanical, chemical, biological, and geothermal industries). However, using nanofluids in high-temperatures and high-pressures and other severe environmental conditions (high pH-condition, salinity, for example) are related with some problems. For example, nanoparticle dispersions are often difficult to stabilize in harsh downhole environments [1] when nanoparticle dispersions applied to enhanced oil recovery. Also, the interaction between the base fluid and solid nanoparticles (for example, wetting properties, hydrophilic or hydrophobic properties, structure of the transition zone between the bulk liquid and solid surface) plays important role in observed properties of nanofluids. Since most nanoparticles employed a dispersant (or stabilizer) or surfactants for stabilizing of the nanofluids, their effect on measuring properties still unclear, for example, surfactants thermal decomposition is considerable affecting on the nanofluid properties, therefore, on their practical applications. Thermal decomposition of the surfactants leads to destabilization of nanofluids, i.e., agglomeration or precipitation of nanoparticles and subsequent damage to the technological process. Thus, instability renders the nanofluid ineffective and often leads to unexpected results. Due to surfactant thermal decomposition the dispersion can quickly become unstable and agglomerate when the base fluid is subjected to change in pH, or encounters increased salinity and temperature. Among different factors, the effect of temperature on destabilization of nanofluid is extremely important [1]. However, the effect of temperature on the stability and the measuring properties of nanofluids very poorly understand. In the present work we have studied the effect of thermal instability on nanofluid ethanol+diamond (3 to 10 nm size) critical behavior. We experimentally found that at temperatures above 500 K thermal destabilization of the nanofluid completely changes the temperature behavior of heat capacity. For example, the phase transition temperature of the nanofluid considerable shifts to high temperature in compare with pure ethanol. Also heat capacity discontinuity for pure ethanol near the critical point is smoothed for nanofluid.

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