Measurements of Heat Capacity of Carbon Nanotube Ionanofluids and Data Analysis by Mathematical Gnostics.

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In thermal energy storage systems, ionic liquids can be used as alternative heat transfer fluids because they have specific properties like negligible vapor pressure, they are nonvolatile, nonflammable, and show high thermal stability and chemical stability.[1,2] Adding nanoparticles into ionic liquids leads to a new class of heat transfer fluids termed as ionanofluids (INFs). Literature data on ionanofluids are scarce, however the few data available show they possess a great potential for advanced energy storage applications. Further study is required to fully understand the heat transfer behavior of ionanofluids.[3,5,7] In present research work, influence on isobaric heat capacity is studied by adding nanoparticles in base ionic liquid (ionanofluids).

Ionanofluids samples have been prepared by doping different amount of Multi Wall Carbon Nano Tubes (MWCNT) into 1-ethyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide ([EMIM][Tf_2N]) base ionic liquid. Different concentration ionanofluids samples were prepared by adding different measured amount of MWCNT by weight fraction in to the base ionic liquid [EMIM][Tf_2N]. Mixing of ionic liquid [EMIM][Tf_2N] and MWCNT was performed at 220 rpm, 1 mbar pressure and 50 °C temperature for two hours on the Rotavapor R-300. A properly mixed solution is submerged in 30 minutes of ultra sonic bath where it is converted to viscous fluid or gel.[2,3,6] A rheological experiment showed complex viscoelastic behavior of ionanofluid [EMIM][Tf_2N] dispersed with MWCNT.

Measurements of isobaric heat capacity as function of temperature (20 ° to 70 °C) for base ionic liquid [EMIM][Tf_2N] and prepared ionanofluids, [EMIM][Tf_2N] dispersed with MWCNT have been carried out by μDSC 3 Evo microcalorimeter manufactured by Setaram. Measured isobaric heat capacity data of ionanofluids samples are compared to that of the pure ionic liquid to study the change in isobaric heat capacity for different amounts of dispersed MWCNT. Significant change in isobaric heat capacity is noted in the studied temperature range for samples with different concentrations. Furthermore, these experimental isobaric heat capacity data have been assessed by nonstatistical data analysis methods named as mathematical gnostics (MG). Based on the thermodynamic data and theory of measurement, mathematical gnostics is a novel approach towards data uncertainty.[2,4] MG marginal analysis was used to evaluate the interval of typical data and the tolerance interval for each measured data point. Moreover, a robust linear regression along a gnostic influence function was used to find the best curve fit for the measured data.

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