

## Thermophysical properties of deep eutectic solvents and boron nitride based nanofluids as thermal fluid and steam quality study

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**Abstract:** The current work reports the thermophysical properties of novel thermal fluid based on Deep Eutectic Solvent (DES) and Boron Nitride (Hexagonal) nanoparticles namely Nanoparticle Dispersed Deep Eutectic Solvents (NDDDES). The DES was synthesized using a Hydrogen Bond Donor(HBD) i.e. DL-Menthol and a Hydrogen Bond Acceptor (HBA) namely Diphenyl Ether by using a molar ratio of 1:1.2 at a temperature of 350.15 K. NDDDES or Nanofluids were prepared by dispersing different weight (0.001, 0.002 and 0.005) of Boron Nitride (hexagonal) nanoparticles in the DES. As expected NDDDES's there is a detraction in density, viscosity and a higher enhancement in thermal properties like thermal conductivity (figure 1) and volumetric heat capacity (figure 2) and as compared to DES. From the shear stress and strain curve both the DES and NDDDES were found to be of Newtonian in nature. In order to evaluate the steam properties by using DES as a thermal fluid, Aspen Plus simulation was carried out, in which two heat exchangers (U-Shaped and Shell and Tube heat exchanger) were used to generate steam (figure 3)

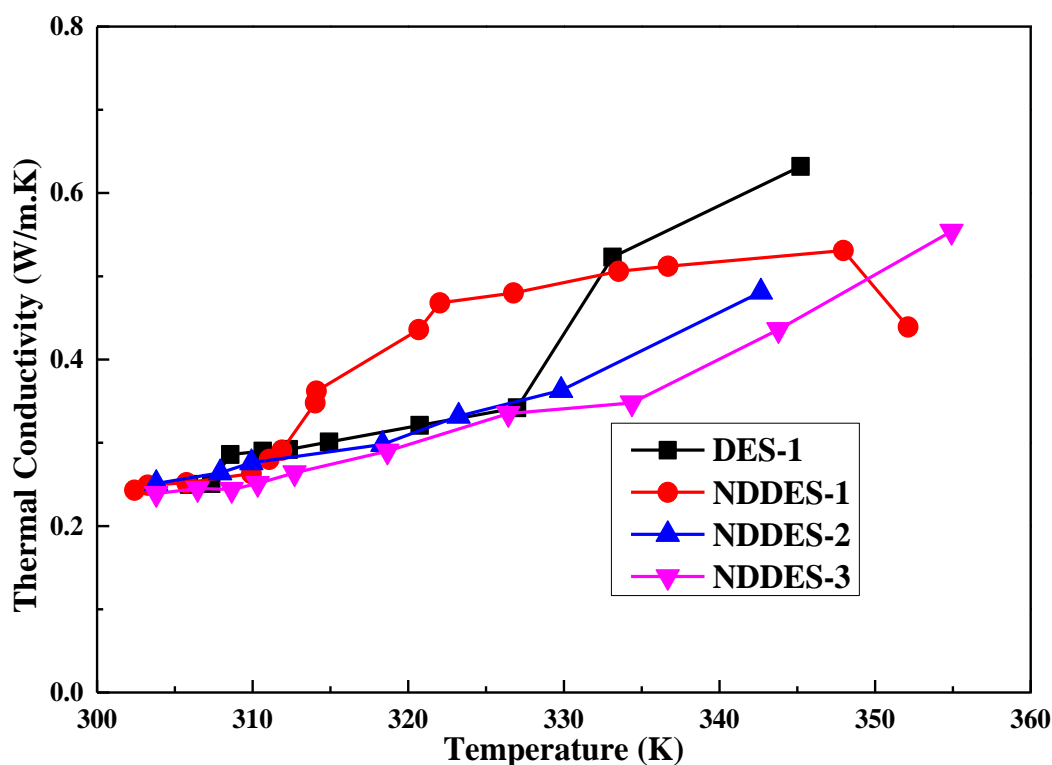


Figure 1: Thermal Conductivity ( $k$ ) of DES and NDDDESs with respect to temperature.

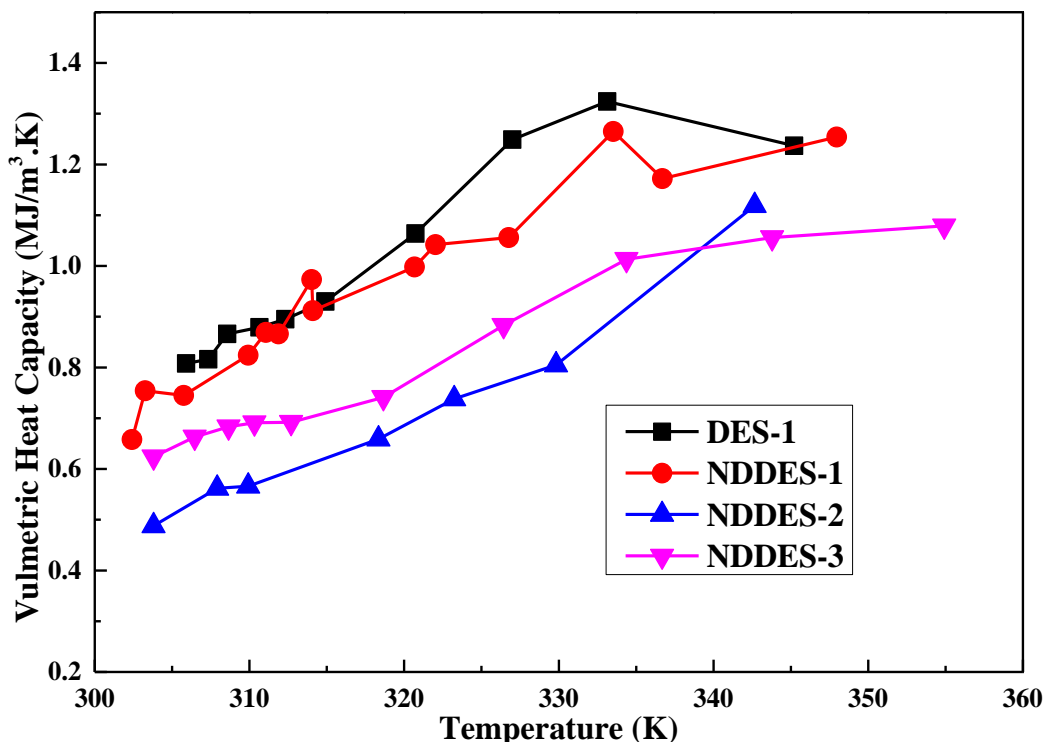


Figure 2: Volumetric Heat Capacity ( $C_v$ ) of DES and NDESs with respect to temperature.

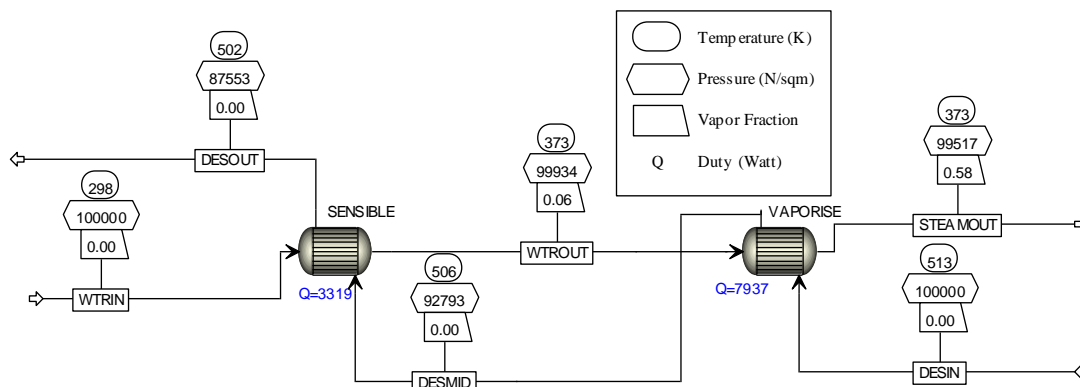


Figure 3: A spen Plus Simulation Flowsheet of Steam Generation System

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