Isobaric Molar Heat Capacity Measurements of Binary Mixtures of Ethyl Laurate and Ethanol at High Pressures

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Biodiesel composed of fatty acid alkyl esters, which has the advantages of high cetane number, high flash point, low or no sulfur contents, renewable, etc., has been blended with diesel fuel in diesel engines as an environmentally friendly fuel. However, the addition of biodiesel may increase the NOx emissions in combustion process [1]. Ethanol, as being an additive in diesel engines, can significantly improve spray characteristics and reduce the NOx emissions [2, 3]. The thermophysical properties of biodiesel are important elements for diesel engine design, which are influenced by the fatty acid alkyl esters in it [4]. Heat capacity, one of the thermophysical properties, is required for modeling the in-cylinder spray and combustion processes [5], while the heat capacity data of fatty acid alkyl esters, especially its mixtures with ethanol are deficient. Therefore, the measurement of accurate heat capacity data of fatty acid alkyl esters and ethanol mixtures is valuable. In this work, a flow calorimeter was constructed to measure the isobaric molar heat capacities of the mixtures of ethyl laurate and ethanol at temperatures from 293 K to 343 K and pressures up to 25 MPa. The system was tested by measuring the isobaric molar heat capacities of pure water and ethanol at different temperatures and pressures, and the relative expanded uncertainty of the results was estimated to be lower than 1 %. Based on the excess molar heat capacities, the deviation of the mixtures from the ideality was evaluated. Furthermore, a collection for the isobaric molar heat capacities of ethyl laurate and ethanol mixtures was proposed, and the comparison between the calculated results and the experimental data was implemented.