Liquid-Liquid Phase Behavior of Diesel/Biofuel Blends: Ternary Mixtures of *n*-Hexadecane, 2,2,4,4,6,6,8-Heptamethylnonane and Ethanol and the Binary Subsystems

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Mixtures of *n*-hexadecane and 2,2,4,4,6,6,8-heptamethylnonane are common diesel fuel surrogates for fundamental research. This paper describes a systematic investigation on the liquid-liquid phase behavior of the normal alkane *n*-hexadecane and its isomer 2,2,4,4,6,6,8-Heptamethylnonane (both C_nH_{2n+2}; n = 16) with ethanol. By applying the cloud point method in the temperature range of T = (240 - 330) K at ambient pressure the phase diagrams were obtained. The binary sub systems of both isomeric alkanes show partial miscibility with upper critical solution points. The behavior of the ternary mixtures is examined by a stepwise determination of quasi-binary subsystems where the ratio of the two isomers was varied. By changing the ratio of the different isomers the region of the liquid-liquid coexistence is gradually shifted towards lower temperatures when adding the branched isomer. The general shape of the phase bodies of the pseudo-binaries, mainly pre-defined by the quite similar properties of the isomeric components, show only a slight change. A master curve obtained when applying the corresponding state principle on the single pseudo-binary mixtures proves the validity of the assumption of evaluating the different mixtures by the well-known concepts applied for binary solutions. Therefore, Ising criticality is presumed for the analysis of the mixtures. A superposition of the different results allows for a comprehensive description of the liquid-liquid phase behavior, the loci of critical points, and tie lines. The limits of the range of validity of the descriptions are determined by the appearance of solid phases, which are also reported here.