

Investigation of Ternary Mixtures of *n*-Alkanes and Gases by Dynamic Light Scattering

Andreas Heller^S

Erlangen Graduate School in Advanced Optical Technologies, University of Erlangen-Nuremberg, Erlangen, Germany

Jiaqi Chen, Matthieu S. H. Fleys and Gerard P. van der Laan
Shell Global Solutions International B.V., Amsterdam, Netherlands

Michael H. Rausch and Andreas P. Fröba^C

Erlangen Graduate School in Advanced Optical Technologies, University of Erlangen-Nuremberg, Erlangen, Germany
Institute of Engineering Thermodynamics, University of Erlangen-Nuremberg, Erlangen, Germany
apf@ltt.uni-erlangen.de

It is still an open question which information can be expected from dynamic light scattering (DLS) experiments for ternary mixtures. A theoretical approach suggests that DLS signals originating from ternary mixtures could be governed by fluctuations in temperature and two individual contributions connected with fluctuations in concentration which are related to the Fickian diffusion matrix. Until now, this approach could not be proven appropriately by experiments. In the present study, ternary mixtures consisting of *n*-dodecane ($n\text{-C}_{12}\text{H}_{26}$) and *n*-octacosane ($n\text{-C}_{28}\text{H}_{58}$) with dissolved hydrogen (H_2), carbon monoxide (CO), or water (H_2O) are considered as model systems. To provide a reliable data base for comparison, the thermal diffusivity of the pure substances and also the mutual diffusivities of their binary mixtures which constitute the ternary mixtures were investigated. For the ternary mixtures, three different signals could be distinguished from the time-resolved analysis of the scattered light intensity by using photon correlation spectroscopy. It could be evidenced that the signals are clearly associated with hydrodynamic modes as suggested by the theoretical approach. The fastest mode observable for a ternary mixture matches with the mode associated with the thermal diffusivity in the corresponding binary *n*-alkane mixture. The two further modes obviously connected with the molecular mass transport are observable on different time scales. These two modes in the ternary mixture are comparable to the modes associated with the concentration fluctuations in the corresponding binary mixtures.