# Viscosity and Interfacial Tension of Liquid Organic Hydrogen Carrier (LOHC) Systems by Surface Light Scattering and Conventional Techniques

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Liquid organic hydrogen carriers (LOHCs) have attained increasing interest as an option for safe storage and transport of hydrogen at ambient conditions with reasonable energy densities. For the efficient and economically viable design and modeling of hydrogenation and dehydrogenation processes, accurate data for thermophysical properties such as liquid viscosity and interfacial tension are needed. Yet, the availability of such data is very limited, especially at process-relevant conditions including temperatures up to about 623 K and the presence of pressurized hydrogen being dissolved in the liquid.

In the present contribution, diphenylmethane (DPM) and its hydrogenated derivatives were chosen as an LOHC reference system for a systematic investigation of its thermophysical properties since in contrast to other LOHCs, it does not exhibit positional isomerism. Besides the aromatic, dehydrogenated H0-DPM, the fully hydrogenated H12-DPM and the partially hydrogenated H6-DPM are considered. The latter is present as intermediate product during the hydrogenation and dehydrogenation processes.

The viscosity and interfacial tension of the pure DPM-based fluids as well as their binary and ternary mixtures were obtained simultaneously from surface light scattering (SLS) experiments under inert gas atmosphere. The maximum dynamic viscosity difference between H12-DPM and H0-DPM of 70% at 303 K gradually decreases with increasing temperature up to 593 K. The influence of mixture composition on viscosity and interfacial tension will be discussed in detail. For binary mixtures of H0-DPM and H12-DPM with an extended number of concentrations, for instance, additional measurements by capillary and rotational viscometry at ambient atmosphere and temperatures up to (348 and 423) K, respectively, reveal a minimum at about 25 mol% of H12-DPM. When hydrogen is dissolved in the LOHC at pressures up to 7 MPa, SLS results show a slight reduction of interfacial tension and negligible change of dynamic viscosity compared to inert gas atmosphere at a given temperature.