

3rd World Congress on

Petrochemistry and Chemical Engineering

November 30-December 02, 2015 Atlanta, USA

Hydrogen storage and transport in liquid organic hydrogen carriers (LOHCs)

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Hydrogen is often considered a very capable future energy vector. It can be produced from renewable wind or solar power via water electrolysis and has a wide range of potential applications in all important fields of energy supply. The gravimetric storage density of hydrogen is excellent. One kilogram H₂ carries 33.3 kWh (LHV) of energy. However, being the chemical element with the lowest density, the volumetric storage density of hydrogen is only 3 Wh/liter at ambient pressure. In existing technical applications hydrogen is, therefore, either stored as gas under very high pressures (up to 700 bar, called “Compressed Gaseous Hydrogen” or CGH₂) or in its liquid state at 253°C (called “Liquid Hydrogen” or LH₂). A very attractive way to store and release hydrogen is in form of “Liquid Organic Hydrogen Carriers” (LOHC) systems. Aromatic molecules, such as, e.g., N-ethylcarbazole (NEC) or dibenzyltoluenes can be reversibly hydrogenated and dehydrogenated in order to store and transport hydrogen in form of diesel-like liquids. The presentation introduces shortly the LOHC concept for energy storage and future hydrogen logistics. Afterwards, it concentrates on material and process aspects of LOHC hydrogenation and dehydrogenation catalysis covering the full range from studies on the molecular level (XPS, IR studies) to reactor design and demonstration units. Challenges and optimization potentials will be discussed; novel options (LOHC transfer hydrogenation, hydrogen purification through LOHC hydrogenation/dehydrogenation) will be presented.

Biography

Peter Wasserscheid is a German chemist and professor for chemical reaction engineering at the University of Erlangen-Nuremberg. Together with Matthias Beller he won the Gottfried Wilhelm Leibniz Prize in 2006. Wasserscheid studied chemistry at the RWTH Aachen from 1991 to 1995 before he did his doctorate in the work group of Professor Wilhelm Keim. After postdoctoral research at BP in Great Britain he habilitated at the RWTH Aachen. Since October 2003, Wasserscheid holds the chair of Chemical engineering at the University of Erlangen-Nuremberg. He is also a founder member of the company Solvent Innovation GmbH and Scientific Supervisor in this company since 2001.

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