Axel Kosider et al., J Environ Anal Chem 2018, Volume: 05
DOI: 10.4172/2380-2391-C2-005

9th World Congress on

Green Chemistry and Technology

September 17-19, 2018 | Amsterdam, Netherlands

Recycling of heterogeneous catalysts for the room-temperature decomposition of aqueous formic acid mixtures

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Alternatives to fossil fuels as an energy source are necessary to reach a sustainable tomorrow. A green, renewable and promising energy carrier is formic acid that can be decomposed to hydrogen and carbon dioxide. With a hydrogen capacity of 4.3 wt%, formic acid delivers hydrogen that can be converted to electricity in fuel cells. The decomposition of the acid takes place at mild reaction conditions. With heterogeneous palladium catalysts, the dehydrogenation of aqueous formic acid happens at room temperature and ambient pressure with high selectivity of hydrogen and carbon dioxide. Because of the moderate reaction conditions, hydrogen is obtained on-demand and can be converted to energy. The source for sustainable, green and renewable formic acid is the conversion of biomass to aqueous formic acid. With the help of homogeneous catalysts, biological waste is converted to aqueous formic acid that can be used as green energy carrier. However, while decomposing aqueous formic acid to hydrogen and carbon dioxide, heterogeneous palladium catalysts deactivate within a short time scale. Within a few hours, the activity of the catalyst decreases dramatically so that it is necessary to regenerate the catalytic active material. Regenerating the poisoned heterogeneous palladium catalysts is possible so that the precious metal can be reused for the dehydrogenation of aqueous formic acid. By recycling the palladium catalysts, it is feasible to use formic acid as a renewable and green liquid hydrogen storage chemical.

Biography

Axel Kosider graduated with a Master's degree in Chemical Engineering from the Technical Faculty at the Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU). He is interested in research at the Lehrstuhl für Chemische Reaktionstechnik (CRT) during his semester in South Korea at the FAU Busan Campus. During his studies, he worked as a Research Assistant at CRT, where he then wrote his Master's thesis. In 2015, he began his PhD in the Research Group of Prof. Dr. Peter Wasserscheid.

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