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Biomass upgrading and catalyst characterization using a tandem reactor - GC/MS system

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The promise of converting various biomass feed stocks directly to biofuels or value-added specialty chemicals using catalytic pyrolysis has precipitated a demand for a fast, reliable method to characterize newly developed catalysts. Catalytic pyrolysis is a three-step process: (1) the feedstock is first pyrolyzed (which is often referred to as “fast pyrolysis”), (2) the pyrolyzates flow through a catalyst bed and (3) the ‘products’ are identified and quantitated. The tandem micro-reactor GC/MS system integrates these three processes into a single bench-top instrument. The tandem catalytic reactor is designed for the rapid evaluation and characterization of catalysts in various atmospheres, at different temperatures and pressures. Three modes of operation allow different experiments to be conducted on the same equipment. The GC/MS can operate in an on-line MS mode for continuous analysis of gases from the catalyst bed. Alternatively, the GC/MS can operate in several integrated high resolution GC/MS modes for step-wise experiments on gases exiting the catalyst bed. There is also a flash vaporization mode used for the pyrolysis of a solid sample. The system consists of an upper micro-furnace and lower micro-reactor each with independent temperature and reaction gas controls. The micro-furnace can accept solid or viscous liquid samples in a batch sampling mode with catalysis occurring under different conditions in the micro-reactor. The micro-reactor is designed to allow a quick change of the catalyst bed. Batch or continuous experiments can be performed with this system to evaluate both catalyst performance and to characterize catalysis products. Each capability outlined above will be illustrated using ethanol, wood flower and a variety of catalysts. By adding a newly developed Medium Pressure Flow Controller, the influence of reaction pressure against the rate of glycerine conversion using a palladium catalyst is also demonstrated.

Biography

Michael Soll has completed his PhD in Biology in 1993 at RUB, Germany. Since more than 20 years, he is working in business development, marketing and sales of GC- and LC-MS based laboratory equipment. Since 2014, he is representing Frontier Laboratories Japan in Europe as Business Development Manager.

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