MODEL CATALYSIS WITH LIQUID ORGANIC HYDROGEN CARRIERS

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LOHCs are potential candidates for chemical hydrogen storage in future applications: The materials are high boiling organic molecules that can be reversibly hydrogenated and dehydrogenated in catalytic processes. [1] LOHCs consist of a pair of a hydrogen-lean and a hydrogen rich-molecule. The hydrogen-rich molecule is catalytically dehydrogenated at the time and place energy hydrogen/energy is needed, while the hydrogen-lean molecule is hydrogenated in times when excess energy is available.

In this contribution, two examples of the surface chemistry on dehydrogenation catalysts will be discussed, that is, the perhydro-N-ethyl-carbazole (H_{12}-NEC) [2] and dicyclohexylmethane (DCHM) [3]. DCHM and H_{12}-NEC were adsorbed by physical vapor deposition, and subsequently their reaction was monitored during heating. Although the molecules are quite complex, the individual reaction steps were identified by X-ray photoelectron spectroscopy. We will compare the behaviour of the two LOHCs in detail, concerning their dehydrogenation properties. At low temperatures, we find for both the adsorption of a monolayer, followed by formation of multilayers. Upon heating, the multilayers desorb and subsequently distinct dehydrogenation reactions occur, which will be discussed. At elevated temperatures, decomposition reactions are found; these also will be evaluated in detail, since they are detrimental to the storage cycle of the LOHCs.

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Keywords: Liquid Organic hydrogen carriers, model catalysis, photoelectron spectroscopy.

References

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