The Surface Dynamics of Intermetallic Compounds in Catalysis

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Recent years have seen high interest in employing intermetallic compounds as model catalysts in several heterogeneously catalysed reactions to enable a knowledge-based development. Two scenarios have to be distinguished in which the intermetallic compound is either stable under reaction conditions or is altered during catalysis. While the first case allows setting up structure-property relationships rather straight forward, the latter case is much more complex.

Limited availability of fossil fuels forces our society to explore and develop new building blocks of a future energy infrastructure, which is summarized as "energy turnaround". Hydrogen is likely to play a major part in the future, but comes along with severe storage challenges, necessitating energy intensive cryogenic or high pressure processes. Using methanol as chemical storage for hydrogen can overcome these problems. Hydrogen can be released catalytically at temperatures of 200-300 °C by methanol steam reforming (MSR)

$$CH_3OH + H_2O \rightarrow CO_2 + 3\ H_2,$$

resulting in hydrogen with less than 0.5% CO. The reaction is mostly studied applying $Cu/ZnO/Al_2O_3$ catalysts, which lack a sufficient high-temperature and long-term stability.

Catalysts based on intermetallic compounds can overcome these drawbacks. Moreover, using unsupported material, the surface dynamics under reaction conditions can be revealed applying *in situ* techniques. Investigations on different structurally closely related intermetallic compounds reveal different surface chemistry, reflecting the different chemical potentials resulting upon compound formation.

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