Session of Focus Materialchemie – Wednesday, **06.11.2024** 16:00 @ Seminarraum Lehar 01 (TU-Wien, Getreidemarkt 9, BC, OG. 01, room A46)
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Chemical-Physical Activation Methods for the Absorption and Desorption Processes of Magnesium-Based Materials for Hydrogen Storage

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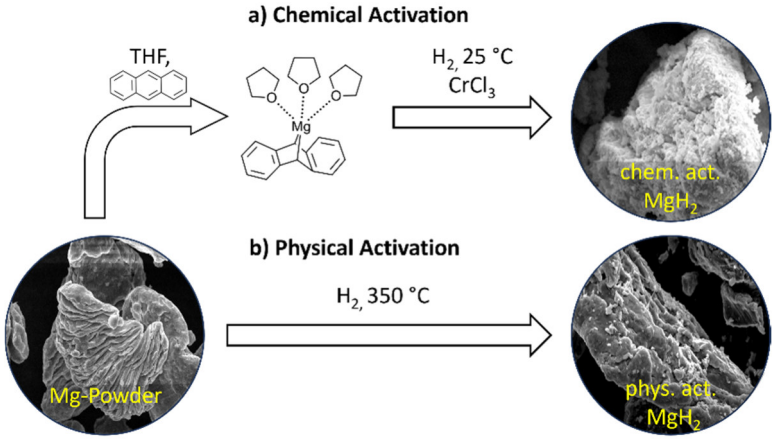

In the context of the energy transition, renewable hydrogen plays a central role as an emission-free energy carrier. The low density of hydrogen gas makes processes for increasing the volumetric energy density necessary. In addition to high-pressure compression and liquefaction, hydrogen can be stored in the form of metal hydrides.

Magnesium is a promising material, but the low reaction speed for hydride formation and the high decomposition temperature for the metal hydride are disadvantageous [1]. This makes the application of physical and chemical activation strategies necessary in order to obtain suitable materials for the efficient storage of hydrogen.

In this study, the effects of physical-chemical activation strategies on the initial hydrogenation of magnesium-based powders from different production routes were investigated. In the case of physical-thermal activation, the production method proved to be a major factor influencing the hydrogenation success. While gas-atomized powders showed a fast initial reaction rate, only incomplete conversion to the hydride was observed in contrast to scratched powders. Chemical activation using Mg-anthracene-chromium chloride catalyst [2] yielded high conversions regardless of the powder preparation method.

The resulting hydride samples differed greatly in their reactivity. The specific surface area changed only slightly during physical activation and by 1-2 orders of magnitude during chemical activation. The activation energy of the dehydrogenation reaction was determined using the Kissinger method. The chemically activated pure magnesium powders showed an activation energy that was about 50 to 65 $kJmol^{-1}$ lower than the physically activated powders. Materials with added nickel (MgNi15) showed even lower activation energies.

[1] K.-F. Aguey-Zinsou, J.-R. Ares-Fernández, *Energy Environ. Sci.* **2010**, *3*, 526.
[2] B. Bogdanovic, *Acc. Chem. Res.* **1988**, *21*, 261.