Why Hydrogen Dissociation Catalysts do not work for Hydrogenation of p-Metals

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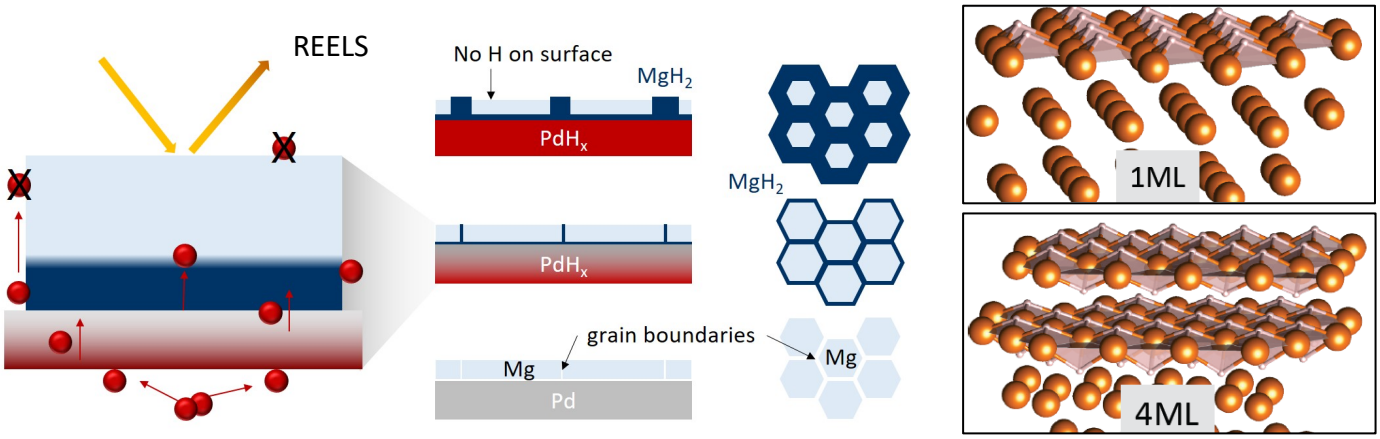
The Magnesium – Hydrogen system is a model system for understanding key processes in hydrogen storage based on p-metal hydrides. Considerable effort has been spent to improve its sluggish sorption kinetics, creating a huge empirical database[1]. In short, the dissociation of H_2 on the Mg surface is highly activated [2]. In contrast to the obvious assumption, overlayers/nanoparticles catalyzing hydrogen dissociation only marginally improve the kinetics.

In this study, in situ time-resolved reflecting electron energy loss spectroscopy (REELS) measurements are used to follow the hydrogen sorption behaviour in magnesium thin films under working conditions enabled by a custom-built setup [3]. The energies of the surface and bulk plasmons are interlinked allowing absolute statements [4]. The measurements, corroborated by electronic structure calculations, demonstrate the hydrogen uptake via growth of magnesium hydride without the presence of chemisorbed hydrogen on the metallic magnesium surface. The observation of the formation of a charge fluctuation layer at the Mg – MgH_2 interface prompts implications of new methods for improving the hydrogen sorption kinetics in p-Metals.



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