

Abstract Submitted
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Hydrogen storage of intrinsic and vanadium-decorated Mg nanostructures YUPING HE, YIPING ZHAO, University of Georgia — MgH_2 is very attractive for future solid state H-storage applications, due to its lightweight, low cost, and high H-storage capacity of 7.6 wt%. However, its practical application is limited by its high thermodynamic stability and sluggish reaction kinetics, which could be improved by making nanostructures with large surface-to-volume ratios to enhance surface reaction activity and by adding an appropriate catalyst to accelerate H-sorption kinetics. In this work, an oblique angle deposition (OAD) or oblique angle co-deposition (OACD) technique has been used to sculpture Mg nanostructures and incorporate a nanocatalyst. For an intrinsic Mg film and Mg nanoblade array by OAD on Ti coated Si, the hydrogenation results show that the nanoblades start to absorb H_2 at $523 \text{ K} < T < 573 \text{ K}$, which is much lower than 623 K for Mg film. The nanoblade morphology with large surface area and small H diffusion length, and the catalytic effect of Ti layer, are two main reasons for the nanoblade hydrogenation behavior. In addition, by OACD, a 2.25 at% V decorated Mg nanoblade array has been fabricated. It can absorb and desorb H_2 rapidly at $T > 500 \text{ K}$ after activation by one hydrogenation cycling, with low H-absorption activation energy of $35.0 \pm 1.2 \text{ kJ/mol H}_2$ and desorption activation energy of $65.0 \pm 0.3 \text{ kJ/mol H}_2$. The improved H-sorption kinetics is attributed to both the catalytic effect of the V coating and the unique nanoblade morphology.

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