

Measurement of PCT isotherms on sodium alanate with different level of Ti doping

INTRODUCTION

In 1997, Bogdanović et al. made a breakthrough discovery in the complex hydride field. They demonstrate that Ti-doping of sodium alanate made the hydrogen sorption reaction reversible, despite the multi-steps reactions involved in the process. The precise role of the Ti in the system is unclear. The GASPRO was used by the same team to study the effect of various level of Ti-doping in the system.

EXPERIMENT

Each sample (~2 g) of the Ti-doped sodium alanate was loaded into the sample holder in the glove box. Before recording the PCIs, samples were subjected to 3 hydrogen discharging/recharging cycles (dehydrogenation: 1 bar, hydrogenation: 130 bar H₂ pressure) which ensures stable performance. Then PCT isotherms were recorded at 160°C for each sample. PCT measurements for each individual doping level were repeated twice. The equilibration time varied between 3.5 h (25mol.% Ti) and 20 h (0.5mol.% Ti) for each datapoint.

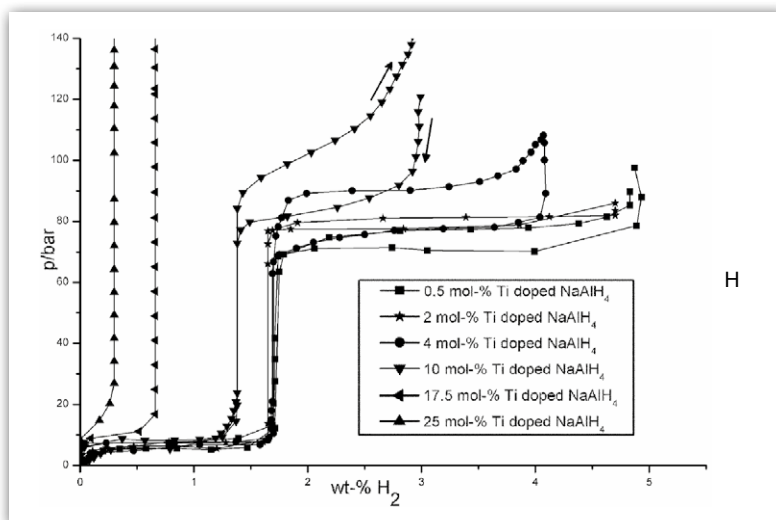


Figure 1: PCT isotherms for 0.5, 2, 4, 10, 17.5 and 25 mol.% Ti doped NaAlH₄ at 160 °C.

RESULTS AND CONCLUSION

The PCT isotherms are strongly modified when the Ti- doping level is changed (fig. 1). This is not consistent with the theory that the titanium is simply a catalyst. These observations clearly demonstrate that the titanium doping of the NaAlH₄ does not just change the kinetics of the system, as expected for a catalyst, but also influences the thermodynamics quite drastically. It has to be underlined that the conditions of the measurements were complicated with a system with extremely slow kinetics where high pressure is needed to reach the plateau. The GASPRO permits work with the most complex hydride systems, like sodium alanate.

INSTRUMENT

GASPRO
-260°C to 500°C



WIDE TEMPERATURE RANGE ENABLING A VARIETY OF APPLICATIONS from sub-ambient operations up to 500+ °C with a customized solution

VARIETY OF MODES OF OPERATION ability to combine PCT, kinetics and cycle-life modes to 200 bar to determine the quantity and rate of sample/gas interaction and its ageing characteristics all in one instrument and operation

HIGH ACCURACY to reduce cumulative error across multiple measurements points

PRECISION MEASUREMENT OF SMALL SAMPLES using the patented microdoser option (US8132476)

EXTERNAL CALORIMETER COUPLING CAPABILITY