MM 4 Wasserstoff in Metallen

Zeit: Freitag 10:30–12:00 Raum: TU H2038

MM 4.1 Fr 10:30 TU H2038

Mesopore Formation in FeAl Ribbons by Supersaturated Vacancies Clustering for hydrogenation studies — •Tomohide Haraguchi[1,2], Astrid Pundt[1], Reiner Kirchheim[1], Hitoshi Hashimoto[2], Kyosuke Yoshimi[3], and Shuji Hanada[3] — [1]Institut für Materialphisik der Universität Göttingen, Friedrich-Hund-Platz 1, D-37077 Göttingen, Germany — [2]Research Institute for Sustainable Development, National Institute of Advanced Industrial Science and Technology, Nagoya 463-8560, Japan — [3]Institute for Materials Research, Tohoku University, Sendai 980-8577, Japan

Many researchers have focused their research on the surface rich materials like zeolites, carbon-related materials, foams and so on. We present the mesopore formation on the surface of rapidly solidified FeAl alloy ribbons. The pores are observed after annealing at definite temperature and are caused by the clustering of the supersaturated thermal vacancies during the relaxation process. The size of pores is several tens nm, this being much smaller than that of porous metallic materials such as foamed, sponge-like and sintered metals. Once a large number of mesopores are formed on the surface, specific surface area would increase drastically. Effect of mesopores on the hydrogen absorption process is also planed to be presented.

MM 4.2 Fr 10:45 TU H2038

Hydrogen absorption of Na-Li alanates prepared by ball-milling — •RYOTA GEMMA[1], HARU-HISA UCHIDA[1], ASTRID PUNDT[2], and REINER KIRCHHEIM[2] — [1]Dept. of Human Development, Tokai University, 259-1292, Kitakaname, Hiratsuka, Kanagawa, Japan — [2]Institut für Materialphysik, Friedrich-Hund-Platz 1, D-37077, Göttingen, Germany

In recent years, complex hydrides based on Na, Li and Al have been of interest for hydrogen storage because of their high hydrogen capacity at around 3-5wt%. In this study Na_2LiAlH_6 prepared by ball-milling was investigated by determining its P-C-T property which has not been well introduced up to now. The extrapolation of the vant́ Hoff plot of plateau pressures showed the possibility of reversible sorption reaction at around room temperature. But, the high apparent activation energy of 110-130 kJ/molH_2 in the absorption was found to be appropriate for middle temperature use. An appropriate mixing of rare-earth oxides powder in the course of milling enhanced the reaction rate. This was interpreted by increased specific surface by finely dispersed oxides.

MM 4.3 Fr 11:00 TU H2038

Characterization of the dehydrogenation of alanates with different catalyst monitored by proton NMR — •Laura Esther Valiente-Banuet, Eva Stanik, and Günter Majer — Max-Planck-Institut für Metallforschung, Heisenbergstr. 3, 70569 Stuttgart

$NaAlH_4$ is a promising material for the development of reversible hydrogen storage systems. The kind of pre-treatment of the material and the catalyst play a crucial role in the increase of the de- and re-hydriding rates. This also influences the reduction in the temperature of dehydrogenation. However, the microscopic mechanism and the change of the hydrogen mobility due to the catalyst are not yet completely understood. In this work we report on NMR studies of the hydrogen desorption from $NaAlH_4$ doped with the catalysts $TiCl_3$ and Ti_{13}-clusters, respectively. The time dependence of the NMR spectra, measured at a given temperature, shows clearly the transition from $NaAlH_4$ to Na_3AlH_6. The hydrogen dynamics in the different compounds is investigated by measurements of the spin-lattice relaxation. In the case of $NaAlH_4$ a double-exponential recovery of the nuclear magnetization is observed, which indicates two fractions of hydrogen with different mobilities.

MM 4.4 Fr 11:15 TU H2038

Lattice distortions in β-$YH_{2+\delta}$ and cubic YH_3 thin films studied by Raman spectroscopy. — •A.-M. Racu[1], M. Rode[1], D. Zur[1], A. Borgschulte[2], R. Westerwaal[2], and J. Schoenes[1] — [1]Institut für Halbleiterphysik und Optik, TU Braunschweig, Mendelssohnstrasse 3, 38106 Braunschweig, Germany — [2]Division of Physics and Astronomy, Faculty of Sciences, Vrije Universiteit, De Boelelaan 1081, Amsterdam, The Netherlands

We have monitored with Raman spectroscopy the metal insulator transition of Y films grown on (111) CaF_2 substrates and capped with Pd. The γ phase (YH_3) has a hexagonal structure characterized by a Raman spectrum with nine lines at room temperature. The stoichiometric β phase (YH_2) is cubic and shows only one line. In the superstoichiometric β phase of $YH_{2+\delta}$ we find changes in the spectra which are not compatible with a cubic lattice. There are clear indications that the cubic lattice is distorted into a tetragonal structure in $YH_{2+\delta}$. The Raman mapping image during unloading of an Y film shows a regime of coexistence between the γ and the superstoichiometric β phase. The results are compared with measurements on $Mg_zY_{1-z}H_x$ which also show a distortion of the cubic lattice.

MM 4.5 Fr 11:30 TU H2038

Ortsaufgelöste thermische Wasserstoffdesorption aus dem Volumen — •Martin Hövel, Matz Haaks und Karl Maier — Helmholtz - Institut für Strahlen- und Kernphysik der rheinischen Friederich-Wilhelms Universität zu Bonn

Die im Flugzeugbau verwendete schweißbare Aluminiumlegierung (AA6013) zeigt, gegenüber der traditionellen Legierung (AA2024), bei einer zyklischen Belastung in korrosiven Medien eine erhöhte Rissausbreitungsgeschwindigkeit, sowie ein langsameres Ausheilen von Punktdefekten in der plastischen Zone. Verantwortlich für dieses Verhalten ist wahrscheinlich der während der Rissentstehung in das Zwischengitter eindiffuniderende Wasserstoff.

Standardmethoden sind für den Nachweis dieser geringen Wasserstoff-Konzentration nicht geeignet.

Die bewährte Methode der thermischen Wasserstoffdesorption wurde weiterentwickelt, um ortsaufgelöst Wasserstoff im Volumen nachzuweisen. Dabei wird die Probe im Hochvakuum (HV) so eingesägt, dass die Späne unmittelbar in einen beheizten Tiegel im darunterliegende Ultrahochvakuum (UHV) Bereich fallen. Der Wasserstoff, der dabei aus den erhitzten Spänen ausdiffunidert, kann über die Druckerhöhung im UHV nachgewiesen werden.

MM 4.6 Fr 11:45 TU H2038

Hydrogen absorption in polymer and surfactant stabilised clusters — •M. Suleiman, J. Faupel, C. Borchers, H. U. Krebs, R. Kirchheim, and A. Pundt — Institute fuer Materialphysik, Univ. Goettingen

In this work the H-absorption behaviour in Pd clusters stabilised in two different matrix, polymer ((hard matrix)) and surfactant ((soft matrix)), will be presented. The effect of the stabiliser type and hence the morphology of the sample on the hydrogen uptake will be studied. Pressure-lattice parameter isotherms, obtained from in situ XRD measurements, were constructed for three samples: surfactant stabilised clusters, and two types of polymer stabilised samples ((clusters and closed clusters layers sample)). The pressure-lattice parameter isotherms for the samples show a narrowed lattice parameter miscibility gap [[1]]. The closed clusters layers sample shows the smallest lattice parameter expansion values. The effect of the samples morphology on the lattice expansion and the plateau slope will be discussed. It will be shown that not only the sample sizes affect the expansion but also the cluster surrounding plays an important rule.

This work is supported by the DPG via SEB 602

[[1]] M.Suleiman, J. Faupel, C. Borchers, H. U. Krebs, R. Kirchheim, A. Pundt submiited to JALCOM