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Structural analysis of aluminum-based hydrides by high intensity neutron total diffractometer (NOVA)

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A high intensity neutron total diffractometer, NOVA, at J-PARC realizes new opportunity to explore structures of crystalline, amorphous and liquid materials in a short time, and clarify the structural changes during hydrogen absorption and desorption reactions of the hydrogen storage materials. Aluminum trihydride (AlH_3, alane) is one of the potential candidates for hydrogen storage materials because of high gravimetric and volumetric hydrogen densities (10 mass% and 149 kgH_2/m^3) and a simple hydrogen desorption reaction ($AlH_3 \rightarrow Al + 3/2H_2$) at 370-470 K. We investigated the structures of AlD_3/AlH_3 before the hydrogen desorption reaction by high intensity neutron (NOVA)/X-ray diffraction (BL02B2 at SPring-8) measurements. The presence of chi-Al_2O_3 (thickness 3-5 nm) on the surface of AlH_3 particles (size 100-1000 nm) may prevent the hydrogen desorption reaction of AlH_3 to Al at room temperature. Also, the local structures including crystalline and amorphous phase during the thermal decomposition reaction from $LiAl(ND_2)_4$ to Li_3AlN_2 and AlN accompanying ammonia desorption were investigated by PDF (atomic Pair Distribution Function) analysis. Some of recent results for structural study of aluminum-based hydrides on NOVA will be presented.

Biography

Kazutaka Ikeda received his PhD from Tohoku University in 2006. During his PhD and Postdoctoral studies at Institute for Materials Research, Tohoku University, he was also a Research Fellow for young scientists of the Japan Society for the Promotion of Science. After serving as an Assistant Professor at the same institute, he moved to Institute of Materials Structure Science, High Energy Accelerator Research Organization (KEK) as a Research Associate Professor. His current research interests include material design of hydrogen storage materials and structural study by comprehensive use of multi-probes such as high intensity neutrons and synchrotron light.

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