O-073 **Alane AlH_3 for Hydrogen Storage.** V. A. Yartys,[1] J. P. Maehlen,[1] R. V. Denys,[1] M. Fichtner,[2] Ch. Frommen,[2] B. M. Bulychev,[3] H. Emerich,[4] Y. E. Filinchuk,[4] – [1]Institute for Energy Technology, Kjeller, Norway; [2]Institute of Nanotechnology, Research Centre Karlsruhe, Germany; [3]Lomonosov Moscow State University, Moscow, Russia; [4]Swiss-Norwegian Beam Line, European Synchrotron Research Facility, Grenoble, France

Alane AlH_3 combines high gravimetric and volumetric densities of hydrogen, making the goal of building a total H storage system with efficiency exceeding 5 wt.% H reachable. AlH_3 forms several polymorphic modifications, from which we have focused our studies on α- and γ-AlH_3. A significant decrease in hydrogen packing density, by 11 %, from 2.09*LH_2 for the rhombohedral α-AlH_3 with corner-sharing AlH_6 octahedra; sp.gr. $R\bar{3}c$; a=4.44994(5); c=11.8200(2) Å to 1.85*LH_2 for the orthorhombic γ-AlH_3 with both corner- and edge-sharing AlH_6 units thus containing double bridge bonds between Al and H; sp.gr. *Pnnm*; a=5.3803(1); b=7.3572(2); c=5.77526(5) Å was found by SR XRD and is caused by a formation of rather large cavities in γ-AlH_3. This results in a decrease of its stability compared to α-AlH_3. Studies of the kinetics and mechanism of the decomposition of α-AlH_3 and γ-AlH_3 performed by *in situ* SR XRD and thermal desorption spectroscopy studies show a higher activation energy of hydrogen desorption from α-AlH_3 compared to the γ-hydride (136 kJ/mol and 92 kJ/mol, respectively). Complex, double-peak, decomposition behaviour was observed for both polymorphs. For the γ-modification, following temperature increase, three overlapping events were observed between 80 and 120 ^{o}C; γ→α transformation and two thermal decomposition processes, for γ- and for α-alane. Decomposition $AlH_3 \rightarrow Al + 3/2\ H_2$, which releases 10 wt.% H, because of small decomposition enthalpy and low desorption temperatures, makes AlH_3 very attractive material for the on-board hydrogen storage applications. This work has received a support from INTAS project 05-1000005-7665 “New Alane: Novel Reversible Hydrogen Storage Materials Based on the Alloys of Al”.