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Eutectic intermediate phase in the ternary complex hydride system

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Hydrogen storage in light hydride systems for mobile applications is a widely discussed but a highly controversial topic because of explosive mixtures of hydrogen with oxygen. This danger, however, is eliminated, if hydrogen is stored in complex hydrides, releasing hydrogen only under significant heat impact.

The main issue for complex hydride mixtures is the kinetics of the reversible reaction with hydrogen. One of prospective candidates is $6Mg(NH_2)_2$:9LiH, promptly interacting with hydrogen when doped with $LiBH_4$. Increase of $LiBH_4$-quantity results in a more significant improvement of the reactions with hydrogen. The catalytic impact of $LiBH_4$ is explained by the formation of low-melting intermediate phases with high Li-ion conductivity: a metastable $Li_2BH_4NH_2$ and a peritectically melting $Li_4BH_4(NH_2)_3$.

In the $LiNH_2 - LiBH_4$ equilibrium phase diagram, the eutectic point, i.e. a mixture with the lowest melting temperature, is located at the 1:2 ratio and 90°C. This eutectic mixture was characterized by various techniques, including neutron total scattering. Its intrinsic structure under the reaction conditions was elucidated by EPSR, which gave a hint about its role as a liquid-phase catalyst in the corresponding hydrogen storage composition ($6Mg(NH_2)_2$:9LiH:$6LiBH_4$ or, as reported in literature, $6Mg(NH_2)_2$:9LiH:$12LiBH_4$).

Author: KUZNETSOVA, Anastasiia (WPN Hereon Garching branch)

Co-authors: Dr GIRELLA, Alessandro (Pavia Hydrogen Lab); Prof. MILANESE, Chiara (University of Pavia); Prof. PISTIDDA, Claudio (WTN Hereon); Prof. MÜLLER, Martin (Helmholtz-Zentrum hereon GmbH); Dr ALDERMAN, Oliver (SANDALS, ISIS); Dr BUSCH, Sebastian (GEMS at MLZ, Helmholtz-Zentrum Hereon, Germany)

Presenter: KUZNETSOVA, Anastasiia (WPN Hereon Garching branch)

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