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Editorial

Hydrides: Fundamentals and Applications

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Both the Japanese and Hawaiian archipelagos are both completely devoid of petroleum resources. Thus the coauthors of this Editorial live in societies that feel an urgent need to develop alternative energy sources. The utilization of hydrogen as an energy carrier in the form of metal hydrides has long been proposed as a key component in strategies for the harnessing of renewable energy sources. In the past, these considerations alone were the impetus for our studies of metal hydrides, however, the motivation for research in this area is evolving. PEM fuel cell powered automobiles have recently been commercialized. This has resulted in efforts to develop metal hydride technologies that will enable rapid expansion of the already existing market that is based on high-pressure hydrogen. The scope of the potential practical applications of metal hydrides has also been extended beyond hydrogen storage to ionic conductors and thermal energy storage. Our goal in assembling this special issue of *Energies* was to provide readers with a sense of the future directions that can be anticipated in metal hydride research in view of these changes. We hoped to accomplish this by providing a sampling of the variety of cutting-edge research efforts on metal hydrides that are currently underway throughout the scientific world.

We are now happy to present the 15 outstanding contributions (13 original research papers and two reviews) that can be found within this special issue [1–15]. With the inclusion of authors from 16 different countries, the issue truly presents a global view. This volume also covers a wide range materials (classical metal hydrides, complex hydrides, and metal hydride composites); and applications (onboard hydrogen storage, off-board hydrogen storage, and thermal energy storage). Although none of the papers focus directly on battery applications or ionic conductors, the findings reported here are also relevant to these topic as well.

We wish to express our deep gratitude to all the contributors the special issue and those that served as reviewers.

References

1. Mao, J.; Gregory, D.H. Recent Advances in the Use of Sodium Borohydride as a Solid State Hydrogen Store. *Energies* **2015**, *8*, 430–453. [CrossRef]
2. Ley, M.B.; Roedern, E.; Thygesen, P.M.M.; Jensen, T.R. Melting Behavior and Thermolysis of $NaBH_4-Mg(BH_4)_2$ and $NaBH_4-Ca(BH_4)_2$ Composites. *Energies* **2015**, *8*, 2701–2713. [CrossRef]
3. Moury, R.; Demirci, U.B. Hydrazine Borane and Hydrazinidoboranes as Chemical Hydrogen Storage Materials. *Energies* **2015**, *8*, 3118–3141. [CrossRef]
4. Denys, R.V.; Yartys, V.A.; Gray, E.M.; Webb, C.J. $LaNi_5$-Assisted Hydrogenation of $MgNi_2$ in the Hybrid Structures of $La_{1.09}Mg_{1.91}Ni_9D_{9.5}$ and $La_{0.91}Mg_{2.09}Ni_9D_{9.4}$. *Energies* **2015**, *8*, 3198–3211. [CrossRef]
5. Aboud, M.F.A.; ALOthman, Z.A.; Habila, M.A.; Zlotea, C.; Latroche, M.; Cuevas, F. Hydrogen Storage in Pristine and d10-Block Metal-Anchored Activated Carbon Made from Local Wastes. *Energies* **2015**, *8*, 3578–3590. [CrossRef]

6. Palumbo, O.; Brutti, S.; Trequattrini, F.; Sarker, S.; Dolan, M.; Chandra, D.; Paolone, A. Temperature Dependence of the Elastic Modulus of $(Ni_{0.6}Nb_{0.4})_{1-x}Zr_x$ Membranes: Effects of Thermal Treatments and Hydrogenation. *Energies* **2015**, *8*, 3944–3954. [CrossRef]
7. Ouyang, L.; Ma, M.; Huang, M.; Duan, R.; Wang, H.; Sun, L.; Zhu, M. Enhanced Hydrogen Generation Properties of MgH_2-Based Hydrides by Breaking the Magnesium Hydroxide Passivation Layer. *Energies* **2015**, *8*, 4237–4252. [CrossRef]
8. Li, G.; Matsuo, M.; Aoki, K.; Ikeshoji, T.; Orimo, S.-I. Dehydriding Process and Hydrogen–Deuterium Exchange of $LiBH_4$–Mg_2FeD_6 Composites. *Energies* **2015**, *8*, 5459–5466. [CrossRef]
9. Wang, H.; Cao, H.; Wu, G.; He, T.; Chen, P. The improved Hydrogen Storage Performances of the Multi-Component Composite: $2Mg(NH_2)_2$–3LiH–$LiBH_4$. *Energies* **2015**, *8*, 6898–6909. [CrossRef]
10. Schouwink, P.; Morelle, F.; Sadikin, Y.; Filinchuk, Y.; Černý, R. Increasing Hydrogen Density with the Cation-Anion Pair BH_4^--NH_4^+ in Perovskite-Type $NH_4Ca(BH_4)_3$. *Energies* **2015**, *8*, 8286–8299. [CrossRef]
11. Rönnebro, E.C.E.; Whyatt, G.; Powell, M.; Westman, M.; Zheng, F.R.; Fang, Z.Z. Metal Hydrides for High-Temperature Power Generation. *Energies* **2015**, *8*, 8406–8430. [CrossRef]
12. Yang, J.; Beaumont, P.R.; Humphries, T.D.; Jensen, C.M.; Li, X. Efficient Synthesis of an Aluminum Amidoborane Ammoniate. *Energies* **2015**, *8*, 9107–9116. [CrossRef]
13. Zavorotynska, O.; Deledda, S.; Vitillo, J.G.; Saldan, I.; Guzik, M.N.; Baricco, M.; Walmsley, J.C.; Muller, J.; Hauback, B.C. Combined X-ray and Raman Studies on the Effect of Cobalt Additives on the Decomposition of Magnesium Borohydride. *Energies* **2015**, *8*, 9173–9190. [CrossRef]
14. He, L.; Li, H.-W.; Akiba, E. Thermal Decomposition of Anhydrous Alkali Metal Dodecaborates $M_2B_{12}H_{12}$ (M = Li, Na, K). *Energies* **2015**, *8*, 12429–12438. [CrossRef]
15. Jain, P.; Dixit, V.; Jain, A.; Srivastava, O.N.; Huot, J. Effect of Magnesium Fluoride on Hydrogenation Properties of Magnesium Hydride. *Energies* **2015**, *8*, 12546–12556. [CrossRef]