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Gongbiao Xin

Gaseous and Electrochemical Hydrogen Storage Properties of Mg-Based Thin Films

Doctoral Thesis accepted by
Peking University, Beijing, China

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2. **G.B. Xin**, J.Z. Yang, G.Q. Zhang, J. Zheng, and X.G. Li. Promising hydrogen storage properties and potential applications of Mg–Al–Pd trilayer films under mild conditions. *Dalton Transactions*, **2012**, 41, 11555–11558.
3. **G.B. Xin**, J.Z. Yang, H. Fu, J. Zheng, and X.G. Li. Pd capped Mg_xTi_{1-x} films: promising anode materials for alkaline secondary batteries with superior discharge capacities and cyclic stabilities. *International Journal of Hydrogen Energy,* **2013**, 38, 10625–10629.
4. **G.B. Xin**, J.Z. Yang, H. Fu, W. Li, J. Zheng, and X.G. Li. Excellent hydrogen sorption kinetics of thick Mg–Pd films under mild conditions by tailoring their structures. *RSC Advances,* **2013**, 3, 4167–4170.
5. **G.B. Xin**, Y.Y. Wang, H. Fu, G.L. Li, J. Zheng, and X.G. Li. Promising electrochemical hydrogen storage properties of thick Mg–Pd films obtained by insertion of thin Ti interlayers. *Physical Chemistry Chemical Physics,* **2014**, 16, 3001–3006.
6. **G.B. Xin**, H.P. Yuan, L.J. Jiang, S.M. Wang, X.P. Liu, and X.G. Li. Promising gaseous and electrochemical hydrogen storage properties of porous Mg–Pd films under mild conditions. *Physical Chemistry Chemical Physics,* **2015**, 17, 13606–13612.

Supervisor's Foreword

This thesis describes the scientific achievements of Dr. Gongbiao Xin, which were made during his doctoral program in the College of Chemistry and Molecular Engineering, Peking University. During his Ph.D. study, he obtained a number of important research results on the hydrogen storage properties of Mg-based thin films. As his supervisor, I think the unique experimental procedures and methods, as well as the research results reported in his thesis can provide a valuable reference for researchers in the field of Mg-based hydrogen storage films.

Mg has been considered as the most promising hydrogen storage material due to its low cost, light weight, and high capacity. However, the drawbacks of high desorption temperature and slow kinetics have severely limited its application in the future. Thin films offer a unique opportunity to carry out such studies as their composition, interface, and crystallinity can be well tailored at nanoscale. In addition, Mg-based materials can also be used as negative electrodes in Ni-MH batteries, exhibiting promising applications in the future. In this thesis, the author prepared a series of Mg-based thin films with different structures by magnetron sputtering, and systematically investigated their gaseous and electrochemical hydrogen storage properties under mild conditions. Based on his research work, the Mg-based thin films exhibit promising applications in smart windows, hydrogen sensors, and Ni-MH batteries.

In this thesis, Dr. Gongbiao Xin demonstrated that the addition of Ti and Al interlayers can significantly improve the hydrogen storage properties of Mg-based thin films at room temperature. He also indicated that the optimal thickness of Ti and Al interlayers was 1 nm. Moreover, the gaseous and electrochemical hydrogen storage properties of thick Mg films can also be promoted both by inserting Ti interlayers and by fabricating porous structures, showing great research and application value.

I hope that many readers can gain a broad perspective of the Mg-based hydrogen storage thin films as a result of the author's efforts.

Beijing, People's Republic of China Prof. Xingguo Li
October 2015

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I would like to thank my supervisor Prof. Xingguo Li for his valuable guidance and suggestions throughout my Ph.D. study. The rigorous research spirit and tireless working style of Prof. Li deeply impresses me. Here, I want to extend my lofty gratitude and appreciation to Prof. Li for providing me an excellent platform to carry out the scientific research.

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