

IMPROVING REPRODUCIBILITY IN HYDROGEN STORAGE MATERIAL RESEARCH

Darren P. Broom

Hidden Isochema Ltd, 422 Europa Boulevard, Warrington WA5 7TS, UK

e-mail: dbroom@hiddenisochema.com

Reproducibility has been an issue in experimental hydrogen storage material research, due to publication of results that were later found to be incorrect. Problems affected several materials, including carbon nanotubes and nanofibres, and early reports on hydrogen storage in metal-organic frameworks (MOFs) [1]. A later interlaboratory study, however, of hydrogen sorption by a Mg-based material also showed significant variation [2], so problems also affect metal hydrides [3], and erroneous results continue to be published. This presentation will cover reproducibility and problems in hydrogen storage material research, together with techniques for measuring hydrogen uptake and potential sources of error. Reporting guidelines for hydrogen sorption results, recently proposed by Broom and Hirscher [4], will also be outlined. The main message is that care must be taken when measuring and reporting hydrogen storage results, and sufficient information should be provided to allow results to be replicated by other researchers.

References

- [1] Broom, D. P. and Hirscher, M. Reproducibility in hydrogen storage material research. *Energy Environ. Sci.* **2016**, 9(11), 3368-3380
- [2] Moretto, P., Zlotea, C., Dolci, F., Amieiro, A., Bobet, J.-L., Borgschulte, A., Chandra, D., Enoki, H., De Rango, P., Fruchart, D., Jepsen, J., Latroche, M., Llamas Jansa, I., Moser, D., Sartori, S., Wang, S. M. and Zan, J. A. A Round Robin Test exercise on hydrogen absorption/desorption properties of a magnesium hydride based material. *Int. J. Hydrog. Energy* **2013**, 38(16), 6704-6717
- [3] Broom, D. P. and Webb, C. J. Pitfalls in the characterisation of the hydrogen sorption properties of materials. *Int. J. Hydrog. Energy* **2017**, 42(49), 29320-29343
- [4] Broom, D. P. and Hirscher, M. Improving reproducibility in hydrogen storage material research. *ChemPhysChem* **2021**, 22(21), 2141-2157



Darren Broom is a product manager for Hidden Isochema in the UK. He obtained his PhD in 2003 from the University of Salford, UK, and spent three years as a postdoctoral research fellow at the JRC Institute for Energy in The Netherlands, before returning to the UK to join Hidden Isochema in 2007. He is the author of *Hydrogen Storage Materials: The Characterisation of Their Storage Materials*, a book published by Springer in 2011, and is a UK representative on Task 40 “Energy storage and conversion based on hydrogen” within the Hydrogen Technology Collaboration Programme (Hydrogen TCP) of the International Energy Agency (IEA).