

SEMINAR SERIES

HIGHLIGHTS IN ENERGY RESEARCH

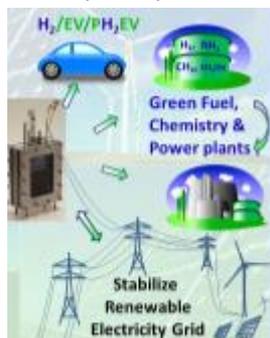
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Towards efficient large scale electricity storage with an integrated Ni-Fe battery and electrolyser

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Grid scale electricity storage on daily and seasonal time scales is required to accommodate increasing amounts of renewable electricity from wind and solar power. The proposal for electricity storage that emerges is that storage in batteries is efficient for the short term while storage in hydrogen based fuels is required for the long term.[1] Towards the realization of that goal a novel approach is taken to battery storage in the form of an integrated battery-electrolyser ('battolyser') that efficiently stores electricity as a nickel-iron battery and can split water into hydrogen and oxygen as an alkaline electrolyser.[2] During charge insertion the Ni(OH)_2 and Fe(OH)_2 electrodes form nanostructured NiOOH and reduced Fe, which subsequently act as efficient oxygen and hydrogen evolution catalysts respectively. Our results demonstrate a remarkable constant and a high overall energy efficiency (80–90%), enhanced electrode storage density, fast current switching capabilities, and a general stable performance during intensive long term tests, all without using noble metals.



As a next step the proposal is to store the hydrogen in the form of liquid ammonia, which can be used as fuel for the production of electricity, and which would enable the full decarbonisation of the electricity sector. A short description of the feasibility of such approach will be discussed.

References

- [1] F.M. Mulder, *J. Renew. Sustain. Energy*, 6 (2014) 033105.
- [2] F.M. Mulder, B.M.H. Weninger, J. Middelkoop, F.G.B. Ooms, H. Schreuders, *Energy & Environmental Science*, 10 (2017) 756-764. HOT paper



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Fokko Mulder graduated with an MSc in Physics from Leiden University the Netherlands. He obtained his PhD degree in 1994 at the same university in the field of magnetic materials and noble metal nanomaterials. After postdoc in polymer materials he started working on energy storage and conversion materials at Delft University of Technology. He became a professor in 'materials for integrated energy systems' in 2008 within the 3TU Collaboration between the three technical universities in the Netherlands.