Hydrogen-induced changes in a Pd nanocluster film

M. Di Vece[1], D. Grandjean[1], M.J. Van Bael[1], C.P. Romero[1], X. Wang[1], S. Decoster[2], J.J. Kelly[3], A. Vantomme[2] and P. Lievens[1]

[1]*Laboratorium voor Vaste-Stoffysica en Magnetisme & INPAC - Institute for Nanoscale Physics and Chemistry, K.U.Leuven, B-3001 Leuven, Belgium*
[2]*Instituut voor Kern- en Stralingsfysica & INPAC - Institute for Nanoscale Physics and Chemistry, K.U.Leuven, B-3001 Leuven, Belgium*
[3] *Debye Institute, Condensed Matter and Interfaces, Utrecht University, P.O. Box 80 000, 3508 TA Utrecht, The Netherlands*

marcel.divece@fys.kuleuven.be

The pursuit of high capacity hydrogen storage materials started long ago and gained new momentum due to the fossil fuel related problems. The use of hydrogen could contribute to a solution[1]. The main aim is obtaining high hydrogen concentrations in a material that possesses suitable transport properties under ambient conditions. A promising way to alter favorably the properties is by reducing its size to the extent that surface and quantum effects begin to play a major role. The investigation of nanocluster metal hydrides may therefore reveal novel properties.

Palladium is one of the most widely studied metals with respect to hydrogen absorption. We investigated the effect of hydrogen on the structure, morphology and optical properties of a palladium cluster assembled film with various techniques: XRD, EXAFS, STM and electrochemistry. These experiments all revealed changes that may affect hydrogenation properties of nanoclusters in a more general way. By electrochemical means we compared the optical change of palladium nanoclusters with an MBE film. With this novel method we found evidence for a core-shell structure in the palladium-hydride nanocluster. These results demonstrate novel properties which in a general way set boundaries for the use of nanoclusters for hydrogen storage.

[1] L. Schlapbach and A. Züttel, Nature, **414**, 353 (2001)