Abstract:
The interaction of hydrogen with the metal lattice determines the enthalpy and entropy of the ab/desorption process. This in turn determines the pressure at which the chemisorbed hydrogen is in equilibrium with the metal, and the associated heat exchange. In this talk I will discuss various ways to change the hydrogen-metal interaction in thin film systems. First of all, it must be stressed that the interaction of hydrogen with a metal host is not at all fully understood, as I will show in the example of the Hf-H system. In addition, in small sized entities the surface energy may alter the equilibrium pressure, however to a limited extent. This effect is observed in a Ti/Mg/Ti multilayer in which we also observe the often overlooked effect of nucleation on the hydrogenation process. A much stronger effect is observed when one is able to prevent the lattice expansion which is associated with the hydrogenation process. To make this happen one imagines to coat individual nano-particles by elastic shells which are yet transparent for hydrogen diffusion. This appears to be difficult task. By chance we discovered a system in which such a clamping takes place in a coherent mixture. By adding 10% of Zr to Y we find that the equilibrium pressure can be enlarged by five orders in magnitude.

Biography:

Bernard Dam obtained his PhD in 1986 in Nijmegen with a thesis on incommensurately modulated crystals. After working at Philips Research Labs on High-Tc superconductors and as an Associate Professor at the VU University in Amsterdam, he is now the head of the MECS (Materials for Energy Conversion and Storage) group at the Delft University of Technology. This group specializes in (photo-)electrochemical conversion processes and devices. The focus of his personal research is the relation between thin film growth, the (defect)structure and the physical properties of materials, lately focusing on oxyhydrides. Presently, he is also scientific director of the ADEM 'Advanced Dutch Energy Materials' program.