Hydrogen Treatment of Materials

PALLADIUM STUDIES AT DONETSK CONFERENCE

The Second International Conference on the Hydrogen Treatment of Materials (HTM-98) was held in Donetsk, Ukraine, from 2nd to 5th June 1998. In an expanding hydrogen economy, the chairman, Professor V. A. Goltsov, emphasised the need for information into the advantages of developing hydriding for hydrogen storage in metals, hydrogen batteries, powder metallurgy and purification of hydrogen; and for reaction products obtained by using palladium alloy membranes – besides the effects of hydrogen embrittlement.

The Goltsov group is interested in phase relationships in the palladium-hydrogen system and are developing techniques for the direct optical observation of $\alpha \leftrightarrow \beta$ phase transitions over a wide range of temperatures and pressures. M. V. Goltsova, Yu. A. Artemenko and colleagues, Technical University (TU) Donetsk, showed striking pictorial sequences of α-phase region developments which supported interpretations by classic kinetic mechanisms of nucleation and grain growth before final adoption of aggregated folded-shape dehydrided forms. These sequences were preceded by initially-smooth β-phase surfaces obtained by hydrogen loading at temperatures of ~ 350°C and pressures of ~ 23 atm.

Results of stresses caused by expanding hydrogen interstitials at phase transitions, and the effects of the stresses on the dynamics of hydrogen flux were confirmed and discussed with regard to oscillatory response effects in palladium and palladium alloys, by L. V. Spivak and N. E. Skryabina, Perm State University, Russia, and by A. A. Katsnelsen and colleagues, Lomonosov State University, Moscow. The latter group reported results on palladium-erbium alloys, compared with earlier studies on palladium-samarium-hydrogen and palladium-tungsten-hydrogen systems.

L. I. Smirnov, T. A. Ryumstana and colleagues, TU, Donetsk, examined theoretical interpretations of hydrogen mobility in palladium and structurally similar metals, relating to stresses produced by regions of structural inhomogeneity. These regions are ones where hydride phase transitions may have occurred and where other elements have been substituted into the lattice.

Stress/Strain Gradient Developments

The importance of Gorsky Effect operations of hydrogen interstitials, corresponding to the development of strain gradients due to lattice expansions caused by hydrogen permeation, was emphasised by K. Kandasamy, University of Jaffna, Sri Lanka and F. A. Lewis, Queen's University of Belfast. They examined hydrogen permeation through palladium, palladium/silver and palladium/platinum membranes with compositions near to $Pd_{77}Ag_{23}$ and $Pd_{81}Pt_{19}$. Knowledge of the pressure-composition-temperature relationships of the membrane is important for correlations with the Gorsky Effect, and estimates of hydrogen diffusion coefficients.

A $Pd_{81}Pt_{19}$ alloy composition, employed for monitoring hydrogen contents, was discussed from standpoints of advantageous reversibilities of inter-relationships between hydrogen chemical potential, hydrogen content and electrical resistivity by K. Kandasamy and colleagues.

A. P. Kuzin and Goltsov reported the development of finely delineated crystallite structures in palladium, after hydrogen absorption and desorption, through regions of $\alpha \leftrightarrow \beta$ phase structural transitions. Preferential development of concentrations of tritium in a D_2O based electrolyte and a $Pd_{72}Ag_{25}Au_3$ alloy electrode were reported by V. D. Rusov and T. N. Zelentsova, Polytechnic University, Odessa, Ukraine. The effects of hydrogen treatment on the mechanical properties of palladium and palladium alloys were reviewed by I. A. Kuzina and colleagues, also from TU, Donetsk.

New and important developments are clearly taking place in the hydrogen-palladium and related systems. Selected papers will be collected in a Proceedings Volume of the *International Journal of Hydrogen Energy*.

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