

by the expansion effects of the hydrogen interstitials, and initial concentrations, n_0 , of the interstitials in the wall. More pictorial representations of the influences of these factors at an intermediate stage (points Y and Y* in Figure 1 (iii)) of both increasing and decreasing pressure "uphill effects" are shown in Figure 1 (iv). Here, for a section of tube wall with an initial hydrogen content, n_0 , further entry of hydrogen into the outer surface has been represented as producing an outward distortion of the tube wall, corresponding to a developing strain gradient, represented by $\text{grad } \epsilon$. This strain gradient has produced a Gorsky Effect transfer of hydrogen away from the inner regions of the wall of a magnitude proportional to n_0 – with a reduction corresponding to Δp of the hydrogen chemical potential and, effectively, a simultaneous equilibration of hydrogen gas pressure within the tube. In complementary studies of permeation rate alterations – resulting from mechanically produced strain gradient responses to pressure changes at the outer surface, involving either hydrogen or any other gas likely to be encountered in technological working conditions – self-consistently clear evidence has now been obtained (10) that the corresponding Gorsky Effect hydrogen transfer in this case supplements the normally expected concentration gradient directed hydrogen flux.

From combined academic and technological standpoints, these studies of hydrogen permeation would now seem to represent particularly clear demonstrations of Gorsky Effect operation. As a consequence of the good opportunities provided through the p-n-T data to obtain quite accurate estimates of the hydrogen contents of both wall substrates and suitably activated surfaces, there has been good progress (13) in matching experimental permeation rates with quantitatively more precise forms of Equation (i) and analogous relationships.

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Protecting Rhodium Catalysts

An understanding of the relationship between the chemistry and structure of rhodium surfaces with their catalytic performance has already been gained from extensive surface spectroscopic investigations. Now, researchers at the University of Pittsburgh, Pennsylvania, have studied the protection of rhodium supported catalysts by potassium functionalisation, in connection with their performance in syngas-related industrial reactions and in automobile exhaust gas converters (M. I. Zaki, T. H. Ballinger and J. T. Yates, *J. Phys. Chem.*, 1991, 95, (10), 4028–4033).

They found that the exchange functionalisation of isolated aluminium-hydroxide groups of the alumina support by potassium carbonate modifier produced aluminium-oxygen potassium groups which stabilise the rhodium/alumina catalysts against rhodium(I) formation.

The functionalisation could thus produce an effective practical method for the protection of environmental rhodium catalysts against loss of catalytic activity due to rhodium(0) degradation.