Polish J. Chem., **78**, 607–609 (2004) **DISCUSSION**

Nickel Hydride: Stroka-Baranowski Effect

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New experimental features concerning problems of the initiations and developments of nickel hydride have continued to become available – since the original formative identification [1,2].

Recently, a further important unexpected effect [3] has been observed within the course of studies of the penetration depth of nickel hydride [4] as indicated in the qualitative representation in Fig. 1.

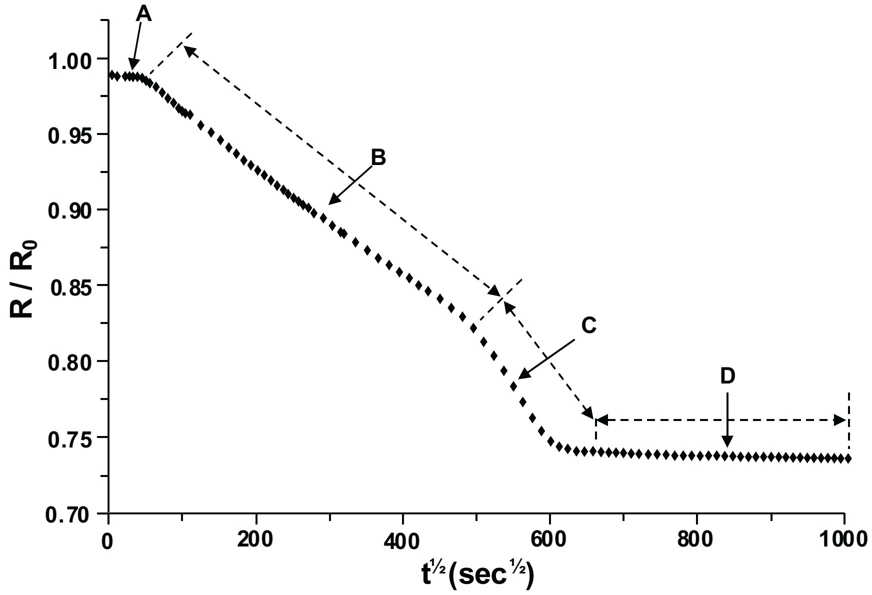

Figure 1. Diagrammatic plots of changes of R / R_0 of Ni specimen in 14.05 kbar of gaseous hydrogen at 25°C. See text for experimental details.

Background of effect: Experimental specimens of the recent studies [2], dimensionally consisted of 13 × 1.5 mm × 50 μm, sheets of highest purity nickel. Measurements of relative electrical resistance, R/R_0 recorded *in situ* by the four pole electrode technique following surface precleaning in benzene and alcohol and insertion and connection in a high pressure apparatus, where they were subjected to pressures of hydrogen gas for prescribed reaction times.

A characteristic example of subsequent time dependent changes of R/R_0 are illustrated in Fig. 1, which indicates corresponding stages of hydrogen interaction, represented as occurring over courses of four distinguishable stages:

An initial period represented by symbol A: An initial period represented by symbol **A**, corresponding to only very minor changes, ascribed [3] to an original induction period, associated with preliminary surface processes and increases of underlying hydrogen content, n, up to limits of the α phase range, corresponding to a hydrogen/nickel atomic ratio, n, $\approx 10^{-3}$ [2].

Second stage, B, of hydrogen interaction: The second stage of hydrogen interaction, represented by symbol **B** in Fig. 1 shows an overall finding of square root dependency, that has been deemed related [3,4] to a parabolic rate interpretation, for a continuous progression of the hydride phase into the main body of the specimen.

Measurements over stages C and D: Section **C**, exhibits an overall evidence of a rapid acceleration of the rate of increase of the hydrogen absorption, before a final approach to region **D,** that is representive of overall hydrogen content equilibration throughout the whole specimen.

Acceleration of rates of hydrogen absorption over the course of section C: The period of acceleration of decrease of R/R_0 over section **C** may be regarded as indicative of changes of interior membrane elastic and energetic conditions.
An interesting explanation of such changes has indeed been proposed by Stroka and Baranowski [3], centred on important concurrent stress/strain factors, operating concurrently with Fickian hydrogen content concentration gradient behaviour.

Behaviour over section C: Such a stress/strain gradient oriented direction of explanation of the very marked increases in the rate of decrease of electrical resistance, R/R_0, over the course of section C in Fig 1 – might seem to have an interrelation with a similar line of explanation for lattice-expansion stress-generated uphill diffusion effects operating in addition to purely Fickian based concentration gradient factors in influences on measurements of hydrogen diffusion coefficients D_H [5,6] in palladium and palladium alloys.

The operation of additional permeation rate factors has been noted in regard to hydrogen migration discussions of optical studies of phase transitions for palladium and palladium alloys [7,8] and general problems of defects and elasticity behaviour [9].

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