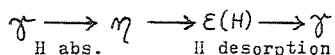
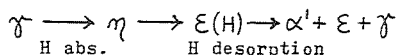


05.1-14 PHASE TRANSITIONS IN HYDROGEN CHARGED AUSTENITIC STAINLESS STEELS. By A. Szummer, Institut of Materials Science and Engineering, Warsaw Technical University, Warsaw, Poland.

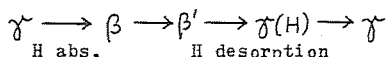
The effect of hydrogen on martensitic transformation in austenitic stainless steels has been established a few years ago /Holzworth, Louthan, Jr., Corrosion, (1968) 24, 110/. X-ray diffraction analyses have shown that in the absence of strain or subzero cooling, cathodic hydrogen charging also can induce the formation of hcp  $\epsilon$  and bcc  $\alpha'$  martensites. However, more detailed investigations revealed that the hydrogen induced martensitic transformation in these steels is preceded by a much more complex process connected with hydride phases formation /Kamachi, Trans. ISSJ, (1978) 18, 485; Szummer, Janko, XI Int. Congress of Crystallogr., Coll. Abs. 06, 3-7, 1978; Szummer, Janko, Corrosion (1979) 35, 461; Narita, Altstetter, Birnbaum, Met. Trans. A (1982) 13A, 1355/. X-ray diffraction studies revealed that cathodic hydrogen charging of both stable and unstable stainless steels induces at the first stage formation of three hydride phases: fcc  $\beta$ , fcc  $\beta'$  and hcp  $\eta$  /Szummer, Kargol, Fiore, Met. Trans. A, to be published/. These phases are unstable at normal conditions and decompose with hydrogen desorption from steel. The vanishing of hydride phases is accompanied by  $\alpha'$  and/or  $\epsilon$  martensitic phases appearance. In stable stainless steels (Type 310) the hydrogen-induced  $\epsilon$  martensite reverses during outgassing to  $\gamma$  austenite indicating that without hydrogen the  $\epsilon$  phase is unstable relative to  $\gamma$  phase. Thus, it appears that under hydrogen of high fugacity the following transition takes place in stable austenitic steels:



where  $\epsilon(H)$  is  $\epsilon$  - martensite with hydrogen in solid solution. The sequence of transformations induced by hydrogen in the case of unstable stainless steels (Type 304) could be performed as follows:



It seems that hcp  $\eta$  hydride phase plays an essential role in these transformations. When aging at room temperature the fcc  $\beta$  and  $\beta'$  phases which have formed during electrolytic charging revert to the  $\gamma$  phase. This transformation can be performed as follows:



where  $\gamma(H)$  is austenite with hydrogen in solid solution.

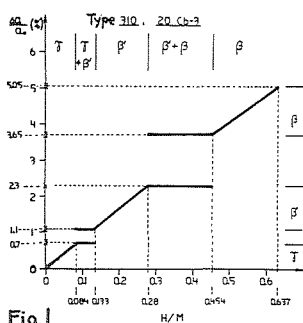


Fig.1

In Fig.1 the established lattice constants change of the fcc  $\gamma$ ,  $\beta$  and  $\beta'$  phases with hydrogen-to-metal (H/M) atomic ratio increase is performed.

05.1-15 REGULARITIES OF HIGH-LOW POLYMORPHIC INVERSIONS. By S.K. Filatov, department of crystallography, University of Leningrad, University emb., 7/9, Leningrad, 199164, USSR

In addition to the theory of polymorphism generalized by M. Burger we advanced here the following postulates (Zapisky VMO, II3, N 2, N 4, 1984). The experimental data results from the thermooentgenographic studies of more than one hundred samples of oxides, silicates, vanadates, tungstates, sulphates, carbonates, borates, sulphides, organic compounds, etc.

We shall proceed from the postulate concluding that from structural point of view polymorphism involves stable, metastable and stabilized polymorphic modifications and in turn it is a component of deformation of crystal structure taking place with a change in temperature.

The experimental data and kinetics of polymorphic transformations indicate that with increasing temperature the number of polymorphic modifications and structural types decreases that is to say "impoverishment" of crystal chemistry takes place. Besides melting the reason is as follows:

Stabilization as well as metastability of polymorphic modifications occurs mainly with decreasing temperature that assists in accumulating polymorphic modifications at lower temperature.

The accumulation explains the fact of setting up the fundamentals of high-temperature crystal chemistry according to the results of structural studies carried out normally at room temperature.

The known tendency of rising crystal symmetry with increasing temperature is explained as follows: With increasing temperature of a crystal the oscillation amplitudes of atoms and molecules about an equilibrium position increase as well as their amplitudes of rocking (rotation) around the axis passing through the equilibrium position. Usually oscillations and rotations cause increase in the symmetry of atoms and molecules, this in turn promotes crystal symmetry. In other words rising symmetry of building particles gives reasons for rising symmetry of the whole construction.

In case of polymorphic modifications connection between crystal symmetry, motive and orientation exists during the transformation and typical features of structure transformation usually appear in thermal deformations of lower symmetric modification. This succession is used for prediction and understanding both the deformation and the transformation.