05.1-08 ON THE DECOMPOSITION OF A Ni-12.5 at. % Al ALLOY.

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Preliminary work had shown that side bands form during decomposition at 550°C of a binary Ni-12.5 at.% Al alloy, suggesting the possibility that the alloy decomposes spinoidally. To test this hypothesis a series of x-ray small-angle scattering measurements were carried out on the 10-meter ORNL machine. Within 15 sec annealing, significant SAS was observed in the form of an isotropic shell about the origin of reciprocal space. However, these kinetic data were not in quantitative agreement with the Cahn-stage spinoidal decomposition relationships.

A comprehensive survey, largely based on electrical resistivity measurements, indicated that the behavior of this alloy is strongly dependent on the decomposition temperature. Between about 225 and 650°C, a temperature dependent modulated microstructure develops within the first few seconds of annealing. Below about 400°C and for annealing times of up to at least two weeks, there is perfection of this component of the microstructure. On the other hand, between 400 and 650°C nucleation and growth of ordered Ni_3Al quickly occurs, superimposed on the modulated microstructure.

05.1-09 THE LATTICE PARAMETER OF Cu_2NiZn.

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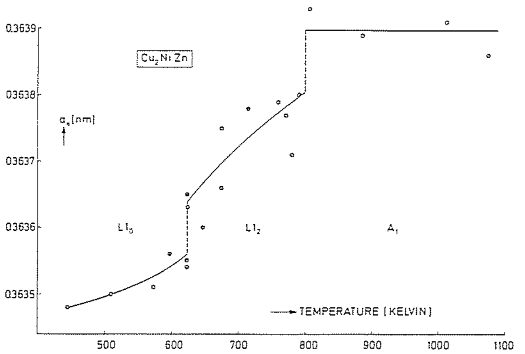
A single crystal of Cu_2NiZn was grown by the strain anneal method which produced small but very good crystals with respect to homogeneity of composition and low mosaicity, although one had to check the sample for the occurrence of deformation twins. A slice of crystal was spark cut in a <210> orientation and X-ray data were collected with the Bond-technique (Acta Cryst. 13, 814(1960)) using the 420 reflection and $CuK\alpha_1$ radiation. Lattice parameters measured at 298 K are plotted in the figure below as a function of the quench temperature. From previous measurements (A. De Rooy et al., Acta Met. 28, 1339(1980)) we know that at low temperature the $L1_0$ structure is stable whereas at higher temperature the $L1_2$ structure prevails. Both transitions at 623 and 800 K, respectively, are clearly noticeable.



05.1-10 HYDROGEN INDUCED STRUCTURAL CHANGES IN AUSTENITIC STAINLESS STEELS.

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Electrolytic charging of Cr-Ni austenitic stainless steels with hydrogen at room temperature induces phase transformation, hydride formation and surface cracking /A. Szummer, A. Janko, XI International Congress of Crystallography, Collected Abstracts 06, 3-7, 178. Warszawa 1978. A. Szummer, A. Janko, Corrosion /1979/, 35, 461. K. Kamachi, Transactions ISSI /1978/ 18, 485/. The X-ray diffraction phase analysis reveals after hydrogenation the presence of three alloy hydride phases: two f.c.c. hydride phases H_γ and H'_γ with different lattice constants, and the h.c.p. hydride phase $H\varepsilon$. Also ε-martensite and, in metastable austenitic steels, α-martensite is formed during hydrogenation.
The hydride phases are unstable under normal atmospheric conditions and decompose when electrolytical charging is stopped. Under the phase process - austenite $\rightleftharpoons$ alloy hydride phases - some irreversible effects take place in the real structure of these steels : the density of dislocations increases significantly, many stacking faults are formed, the austenite peaks broaden and shift to the lower angles, and some amount of ε-martensite and in metastable austenitic steels also α-martensite remain after the desorption of hydrogen. One can notice that the α-martensite diffraction line does not change its position like austenite peaks /Fig.1./, that means the interaction of hydrogen atoms with b.c.c. lattice is different and does not change the lattice constant as much as in the case of f.c.c. and h.c.p. structures which are close packed.

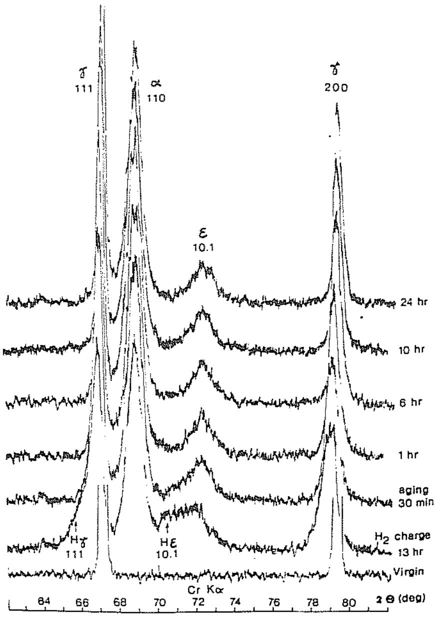

Fig. 1. Effect of hydrogen charging and aging time at room temperature on X-ray diffraction patterns of 18Cr-10Ni stainless steel.