4-16 wt. pct. transforms to a stable close packed phase under pressure without the occurrence of reversion. The addition of manganese to iron also decreases the transition pressure from 133 kbar for pure Fe to less than 70 kbar for Fe-14Mn. X-ray diffraction, electron-probe microanalysis, electron microscopy, and density results indicate that for the Fe-4Mn and Fe-7Mn alloys, the FCC phase has been stabilized after shock deformation, while the ε-phase has been stabilized for the Fe-14Mn alloy. Saturation magnetization studies have detected a residual reduction in magnetization due to the retainment of the high pressure phase. The results have shown that manganese has modified the temperature-pressure diagram of iron by increasing the field of stability of the FCC and HCP phase. In addition, the reversion to a BCC structure has been prevented by two sets of dislocations interacting to form an extremely high dislocation density.

WEDNESDAY AFTERNOON, 31 MARCH 1971　　　　　EMBASSY ROOM—PICK-CARTER AT 2:00 P.M.

(L. F. MATTHEISS presiding)

Energy Bands in Metals (Alloys, Compounds)

Invited Paper

FH 1. Photoemission Studies of Solids and Surfaces. DEAN E. EASTMAN, *IBM Yorktown*. (30 min)

Windowless photoemission spectroscopy measurements of the energy levels of solids and surfaces using photon energies from 10 to 41 eV will be described. Examples include measurements of d-band structure and optical excitations in crystalline and liquids Au, as well as energy level measurements of metal hydrides (Pd/H) and magnetic semiconductors (EuS). Measurements of chemisorbed gasses and surface oxides will also be described (H_2, N_2, CO, CO_2 and O_2 on Ti metal).

Contributed Papers

FH 2. Electron States of Ordered Copper-Nickel Alloys.* A. C. SWITENDICK, Sandia Laboratories -- APW band calculations have been performed for a cubic structure A_3B where A or B = Cu or Ni or Z (a zero potential region). B is at the cube corners and the A's are in the face centers. For Cu_3Cu the fcc Brillouin zone is just mapped back onto the cubic zone four times $\Gamma \rightarrow \Gamma$, $X \rightarrow \Gamma$, $L \rightarrow R$, $W \rightarrow X$, etc. For A_3B, $B \neq A$ the cubic zone becomes appropriate and certain of the original states having charge density at the B site are modified. For Cu_3Ni the modified states are elevated in energy and a set of d-bands which are associated with the nickel site are above the original copper d-bands. For Ni_3Cu the modified states are more uniformly distributed throughout the nickel d-band energy range. These results are in qualitative agreement with the photoemission results of Seib and Spicer[1] for nickel-copper alloys which they interpreted in terms of an Anderson-like model.

FH 3 Calculation of Electronic Properties of Noble Metal Alloys in the Rigid-band Model.* J.M.TRACY and R. H.CAMPBELL, Univ. of Washington--The density of states, optical mass and the intraband conductivity tensor elements have been calculated for the constant energy surfaces of noble metals using the Fermi surface expansion parameters given by Halse[1]. Different constant energy surfaces simulate the Fermi surfaces for alloys of different electron-per-atom ratios in the strict rigid-band model. The calculations are useful to compare qualitative expectations with experimental results for weak-scattering alloys. The behavior around the expected second set of Fermi surface necks is of particular interest. A comparison of the calculations with the measured Polar Reflection Faraday Effect in α-phase silver-cadmium alloys will be given.

FH 4 Application of Coherent Potential Theory of Off-Diagonal Randomness to Disordered Binary Alloy.* S.M.BOSE, Drexel Univ.--The recently developed two-site coherent potential approximation[1] has been used to describe the electronic structure of a one-dimensional disordered binary alloy. A sixth degree equation is obtained for the appropriate Green's function whose imaginary part gives a measure of the density of states. Explicit calculation of the total density of states indicates a broadening and a shift in position of the impurity band.

FH 5 Notes on the Electronic Spectrum of a One-Dimensional Random Alloy.* J.E. Gubernatis and P.L. Taylor, Case Western Reserve Univ.--The electronic spectrum for a simple model of a one-dimensional, random, binary alloy was calculated numerically by self-consistently solving a functional equation due to Agacy and Borland. The behavior of the density of states near a band-edge was examined and found to display the type of essential singularity suggested by Lifschitz. Within the band the density of states was observed to vanish at the points predicted by Wada. Focusing on one of these points, we found that the density of states near this point exhibits the same type of essential singularity as at the band-edge. A characteristic of the spectrum is the presence of peaks. We were able to determine that these peaks

POINT DEFECT RECOVERY OF SHOCK DEFORMED

IRON ALLOYS

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1. Introduction

Recovery phenomena in iron alloys indicate that various measurable properties may recover at different rates[1], [2]. The recovery of electrical resistivity in deformed, quenched and irradiated metals has shown that point defects have been produced. Kressel and Brown[3] have shown that point defects dominate the microstructure of shock deformed nickel. Murr and Vydyanath[4] have attributed thermal recovery of shock loaded 304 stainless steel to the annealing out of point defects. The work of reference (4) employed microhardness measurements to monitor recovery. Previous experimental work[3] has shown that electrical resistivity is sensitive to vacancy and interstitial changes in shocked metals. No experimental results on the recovery of electrical resistivity of shock deformed iron alloys have been published. This paper investigates the nature of defects formed and the recovery of initial flow stress and electrical resistivity in shock deformed iron manganese alloys.

2. Experimental Details

The Iron manganese (Fe-7.37 wt & Mn) specimens were initially annealed at 900°C and furnace cooled. The shock deformation was accomplished in the usual manner[5]. The variation of flow stress with the amount of shock deformation and length of recivery anneal was determined by straining the shocked specimens in a Tinius Olsen machine. The four probe resistivity technique was used to measure resistivity as described elsewhere[3].