MICROSTRUCTURAL STUDIES OF HYDROGEN AND
DEUTERIUM IN BCC REFRACTORY METALS.

Progress Report
A ~~Renewal Proposal~~ on
Contract E-(40-1)-5111

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PROGRESS REPORT

Over the past contract period our work has mainly involved the analysis of X-ray data collected by Dr. Metzger in Munich, the preparation of single crystals of vanadium (V) and tantalum (Ta) for X-ray, neutron and Compton experiments, the planning of a specific neutron experiment at Argonne on D-D correlations in V above its ordering temperature, the initiation of the Compton profile measurements in pure V and the set-up and preparation of the X-ray diffraction equipment. We have been somewhat delayed in our X-ray work because the major equipment ordered under an NSF grant was processed through the State of Texas and Rigaku presented an additional unforeseen delay of three months in shipment. The entire package is due in mid-February and should be set up to perform the scattering studies within two months (maximally) after that. In the meantime all of the electronics has been received and set up and special samples holders and monochromator housings are being constructed in anticipation of the major equipment.

Details of our progress are as follows:

1. H in Ta. (X-rays)

Based on X-ray data collected at Munich we have analyzed the influence of the static Debye-Waller factor on the Huang diffuse scattering from concentrated solutions (a previous paper of Metzger and Peisl is included for information on H-Nb scattering). We have shown that even at 18.2 at. pct. H in Ta the hydrogen interstitial can be treated as an isolated (uncorrelated) defect, that there is no clustering and that the linear super position of defect displacement fields applies. This work is being presented at the March APS meeting and at the 2nd International Conference on Hydrogen in Metals, Paris, June 7-11, 1977. The APS abstract is in-

cluded here.

2. D in V. (neutrons)

Two single crystals of V of approximately $1\frac{1}{2}$ " in length have been oriented along [110] etched and degassed in 10^{-10} vacuum at 1500°C to remove all carbon, oxygen and nitrogen. These crystals will be taken to Argonne in mid-February where they will be charged with D to approximately 35 at. pct. in preparation for an immediate experiment on the D-D correlation in V above its ordering temperature. More will be said of this experiment in the proposal section.

3. D, H in V (Compton)

The pure V crystal noted above is currently being run in the γ -ray Compton apparatus to determine momentum distributions along [100], [110] and [111]. Anisotropies will then be calculated. After the neutron experiments are completed the Compton will be run again on the deuterated sample above T_c and the anisotropies compared.

4. X-ray equipment

X-ray orienters, sample holders, and monochromator housings are being constructed for use both with Huang scattering (near Bragg peaks) using bent germanian and diffuse scattering away from Bragg peaks using doubly-beat LiF. The purchased electronics has been tested and the laboratory facilities for receiving the new X-ray equipment are being installed (power, water, etc.).