April 1964

N65-88229

2p

Brown University, Providence, Rhode Island 02912

Cat 23

NASA CR 56490

Semiannual Status Report 3, 1 October 1963 - 31 March 1964 Code None

STRUCTURE OF ATOMICALLY CLEAN SURFACES OF REFRACTORY METALS

UNPUBLISHED PRELIMINARY DATA

by

H. E. Farnsworth, Barstow University Professor

Joseph E. Boggio, Research Associate

Brown University, Providence, R.I.

Grant No. NASA NsG-373

with

National Aeronautics and Space Administration

This report is intended only for internal management of the contractor and the National Aeronautics and Space Administration

RC#1

A tantalum single crystal whose surface has been cut parallel to a (110) plane has been studied as a function of ion bombardment, heat treatment, and gas adsorption. The major measuring technique employed has been low energy electron diffraction supplemented by photoelectric and stopping potential measurements.

It has been found that ion bombardment of the "(110) surface" of tantalum produces a surface consisting of (130) and (310) planes. Using the Fowler method, the work function of these planes has been determined as 457 ± 0.02 ev. Annealing the (130) surface at temperatures up to about 700°C increases the intensity of the observed diffraction pattern. At 700°C$\pm$25°C the (310) surface atoms become mobile and produce a (110) surface with a 1/5 order superstructure, as determined by diffraction measurements. The work function of the (110) surface with superstructure has been determined as 4.70 ± 0.01 ev. This surface has been found to be stable up to 1450°C, the highest temperature employed. The measured change in work function is in good agreement, both in magnitude and direction, with the measured change in stopping potential of the crystal.

The (130) planes were found to have a sticking coefficient of ~ 0.16 for oxygen gas, as compared to a sticking coefficient of ≤ 0.01 for oxygen on the (110) surface with superstructure. Because of the low sticking coefficient and because of the "fit" to the Fowler curve, the (110) surface with superstructure is believed not to be characteristic of a clean metal surface. This surface was also found to be inert to nitrogen gas exposure.