

## Tantalum-to-Tantalum

Tantalum surfaces prepared by etching in nitric-hydrofluoric acid solutions can be satisfactorily bonded at 1450° C. and 10,000 psi for 3 hrs. Fig. 10 shows a tantalum self bond possessing parent metal strength and ductility. Care must be exercised to avoid hydrogen pick-up during processing or embrittlement may result.

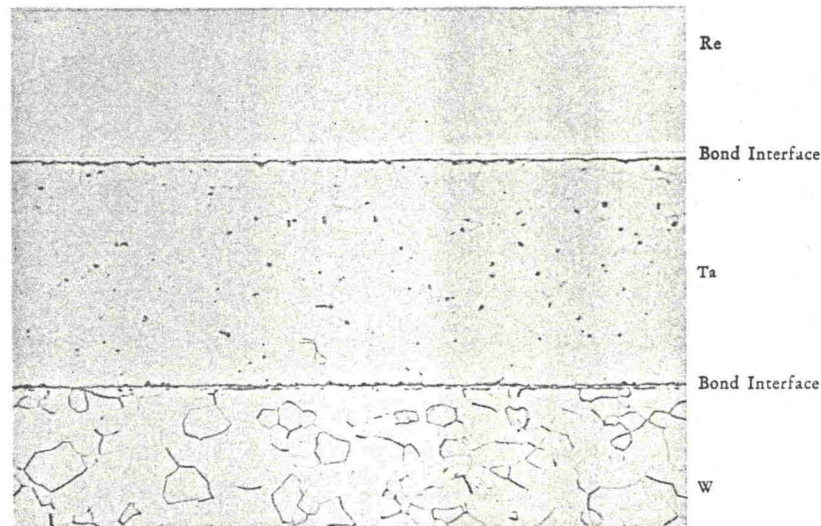


Fig. 11. Bonds between tantalum and rhenium and tantalum and tungsten.  $\times 250$ .

## Tantalum-to-Rhenium

The upper interface shown in Fig. 11 shows the bond formed between tantalum and rhenium at 1600° C. and 10,000 psi for 3 hrs. The bond as formed is strong but very brittle so that crack propagation and fracture along the interface is easily promoted. This brittle behavior is attributed to the X-phase in this system. Exposure at higher temperature only increases the amount of the X-phase and does not help the properties of the joint. No Kirkendall effect has been noted up to 2200° C. in bonded specimens.

## Tantalum-to-Tungsten

Tantalum-to-tungsten appears to be quite similar to the molybdenum-tungsten system in that temperatures above 1600° C. appear required to get high-strength bonds. Fig. 11 also shows a bond formed at 1600° C. and 10,000 psi for 3 hrs. While appearing well bonded, the joint was relatively weak. It is believed that slightly higher bonding temperatures would be

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