formed in a composite diffusion couple. The bond formed is quite brittle due to the presence of σ and X-phases. Use of this bond would be limited primarily to compression-type loadings.

Molybdenum-to-Tungsten

The lower interface in Fig. 6 shows the bond between tungsten and molybdenum at 1600° C. and 10,000 psi for 3 hrs. This bond is rather weak and can be separated in mechanical testing. Higher temperatures appear necessary to enhance the bonding. However, it has been observed in our experiments that a pronounced Kirkendall effect exists in this system and the creation of voids in the molybdenum occurs at a very rapid rate as the temperature of processing is increased. Application of higher pressures should overcome this problem.

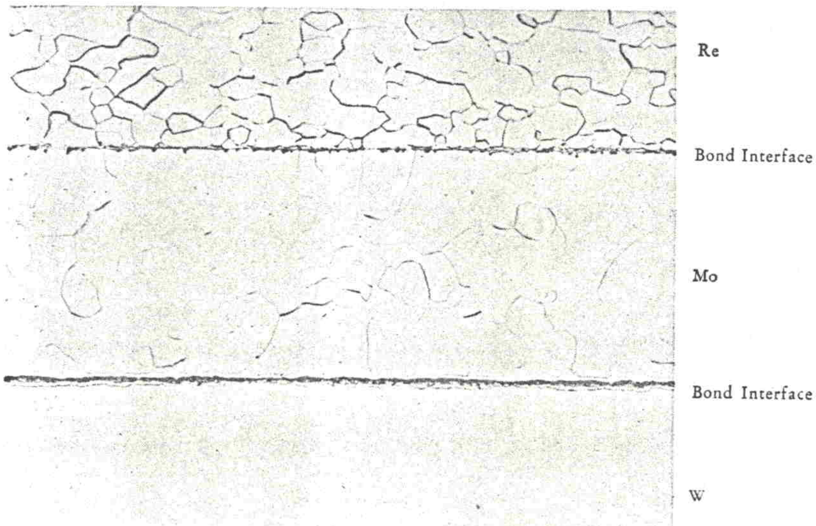

Fig. 6. Bonds between molybdenum and rhenium and molybdenum and tungsten. × 250.

Molybdenum-50 w/o Rhenium-to-Molybdenum-50 w/o Rhenium

This molybdenum alloy can be very nicely bonded at 1600° C. and 10,000 psi for 3 hrs. as shown in Fig. 7. Excellent mechanical properties are achieved with the bond being both strong and ductile. Surface preparation consists of grinding and polishing with fine alumina grit followed by careful cleaning in hydrogen. Bonded specimens have exhibited good qualities on exposure to service at temperatures to 2200° C.

Molybdenum-50 w/o Rhenium-to-Tungsten

Fig. 8 shows the bond between these two materials after pressure bonding at 1600° C. and 10,000 psi for 3 hrs. This bond is mechanically quite strong