Cold pressure welding - the mechanisms governing bonding

Investigations of the bonding surface in scanning electron microscope after fracture confirm the mechanisms of bond formation in cold pressure welding to be: fracture of work-hardened surface layer, surface expansion increasing the area of virgin surface, extrusion of virgin material through cracks of the original surface layer, and establishment of real contact and bonding between virgin material. This implies that normal pressure as well as surface expansion are basic parameters governing the bond strength. Experimental investigations of pressure welding Al-Al under plane strain compression in a specially developed equipment allowing independent variation of normal pressure and surface expansion confirm this. Based upon a slip-line analysis of the extrusion through cracks of the surface layer and upon the establishment of real contact between virgin material, a theory for the bond strength as a function of surface expansion and normal pressure is developed. The theory is in good agreement with the experimental results.

©1979 ASME