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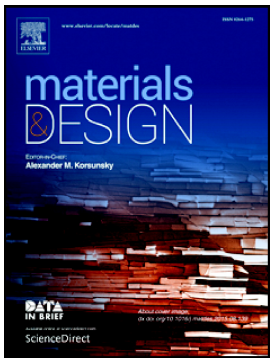

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Microstructure and phase constitution in the bonding zone of explosively welded tantalum and stainless steel sheets

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Abstract

Microstructure and phase constitution in the bonding zone of tantalum and stainless steel explosively welded clads were examined by transmission (TEM) and scanning electron microscopy as well as synchrotron radiation. The macroscale analyses showed that the interface between joined plates were deformed to a wave-shape with solidified melt inclusions located preferentially at the crest of the wave and in the wave vortexes. The micro- and nanoscale analyses revealed a very thin reaction layer at the flat parts of the joint plates. The microstructure and phase distribution of the solidified melt strongly depend on the localization. The melted zones locked inside the wave vortexes predominantly show a uniform chemical composition, whereas those situated at the wave crest a non-uniform phase distribution. TEM investigations of the solidified melt zones unveiled amorphous and nanocrystalline phases of different chemical composition incorporating elements from the joined plates. The parent plates appear to be affected by explosive welding exhibiting a strong increase of dislocation density near the joint. Close to the thicker pockets of the solidified melt recovery and recrystallization processes were observed.

Keywords: Explosive welding; Ta/stainless steel clad; amorphous and nanograins, SEM; TEM; Synchrotron radiation