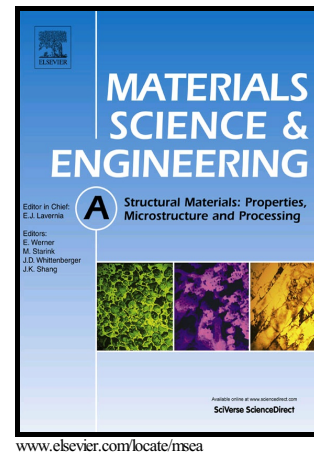


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Gradient effect in the waved interfacial layer of 304L/533B bimetallic plates induced by explosive welding

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Abstract

Relationship between the nano-mechanical behavior and microstructure in the wavy interface zone of explosive welded 304L/533B steel plates was explored. Nanoindentation tests were carried out on the interfacial wavy region across the wave peak and wave valley. The microstructure and chemical components of the interfacial region were obtained. Both across the wave peak and wave valley of interfacial 533B steel, the hardness gradually decreased and then went back to a plateau value of ~ 3.5 GPa. There was no distinct difference in hardness with the distance from interface between the wave peak and wave valley. The reduction of cementite content and the decarburization of interfacial 533B steel were responsible for the decreasing of hardness in the interfacial regions. Moreover, this variation in hardness with the distance from interface was basically inverse to that in ferritic grain size. On the side of 304L austenite steel, the nanohardness gradually increased from the outer region to the interface both across wave peak and wave valley. The relationship between the hardness and the grain size in the graded interfacial zone of 304L steel followed the classical Hall-Petch strengthening equation. The graded variation in hardness could be due to the combined strengthening mechanisms of gradual refined grain size, as well as martensitic transformation strengthening, carbon precipitation strengthening and dislocation strengthening. Also, the hardness in the wave peak zone was larger than that in the wave valley zone of 304L steel, which could be due to the severer plastic deformation occurring in the peak zone.

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