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ABSTRACTS

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POSTERS

Healable Al alloys production by Friction Stir Processing

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Aluminium alloys are commonly used in studies related to Friction Stir Welding (FSW) and Processing (FSP), due to their wide variety of applications. FSP provides grain size reduction; intermetallic rounding, size reduction and redistribution; and an overall increase in ductility. Moreover, FSP becomes a popular method for Metal Matrix Composites (MMCs) production, owing to the homogeneous distribution of reinforcement particles and their good interface with the initial matrix. In this work, a healable Al alloy from a base of Al 6063 is produced using FSP. FSP causes a uniform healing particle precipitation (with a size up to 1 μm), as well as the breakage of Fe-rich intermetallics in the nugget zone. This changes damage mechanism, meaning the classical failure source of Al 6063 - Fe-rich intermetallics - remain intact while the healing particles are broken. Further, at the healing stage, a heat treatment is applied to heal the damage.

Issues in FSW of Aluminum Alloys to Steels and Main Solutions

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Friction stir welding (FSW) is successfully employed in aeronautical and aerospace industries for joining aluminum parts. However, dissimilar FSW of aluminum with steel poses some issues, including the formation of Al/Fe intermetallic compounds (IMCs) and defects (e.g. tunnel, voids, cracks, surface grooves, flash), severe tool wear. All these factors have a detrimental effect on joint quality, mainly reducing mechanical strength under static and dynamic loading conditions. Al/Fe IMCs are brittle phases that usually form at elevated temperature at the Al-steel interface. They mainly promote nucleation of cracks in weld nugget. Tool wear is significant when joining aluminum with steel, thus having a direct effect in cost processing and formation of defects.

In the light of literature, the effects of the most important FSW parameters on the above mentioned issues and possible countermeasures are presented and discussed, including proper selection of process parameters, use of galvanized steel, coating of tools with wear-resistant materials, FSW assisted by laser heat source.
