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A review of friction stir welding of steels: tool, material flow, microstructure, and properties

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Abstract:

Considerable progress has been achieved in friction stir welding (FSW) of steels in every aspect of tool fabrication, microstructure control and properties evaluation in the past two decades. With the development of reliable welding tools and precise control systems, FSW of steels has reached a new level of technical maturity. High-quality, long welds can be produced in many engineering steels. Compared to traditional fusion welding, FSW exhibits unique advantages producing joints with better properties. As a result of active control of the welding temperature and/or cooling rate, FSW has the capability of fabricating steel joints with excellent toughness and strength. For example, unfavorable phase transformations that usually occur during traditional welding can be avoided and favorable phase fractions in advanced steels can be maintained in the weld zone thus avoiding the typical property degradations associated with fusion welding. If phase transformations do occur during FSW of thick steels, optimization of