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平移速度的变化对搅拌焊接材料流动的影响

张洪武, 张昭, 陈金涛

大连理工大学 工程力学系 工业装备与结构分析国家重点实验室, 辽宁 大连 116024

Effect of Translational Velocity on Material Flow in Friction Stir Welding

ZHANG Hong-wu, ZHANG Zhao, CHEN Jin-tao

State Key Laboratory of Structural Analysis for Industrial Equipment, Department of Engineering Mechanics, Dalian University of Technology, Dalian 116024, China

摘要

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摘要 基于有限元方法对不同搅拌头平移速度下搅拌摩擦焊接过程中焊接构件Al6061-T6材料的三维流动问题进行分析,研究了搅拌头平移速度的变化对等效塑性应变的分布和材料流动的影响。结果表明,搅拌头前方的材料向上涌起,被旋推到搅拌头后方并开始向下运动,这一过程是促使搅拌摩擦焊接顺利完成的主要原因。材料的等效塑性应变等值线与不同焊接区域的边界具有较好的对应关系。随着搅拌头平移速度的增加,垂直于焊缝方向上的截面上,等效塑性应变减小,但是材料的流动速度会随之增加。较低的搅拌头平移速度有利于焊缝中心线两侧材料的融合。

关键词: 搅拌摩擦焊接 材料流动 有限元 等效塑性应变 显微结构

Abstract: Finite element method is used to analyze the 3D flow of Al 6061-T6 in friction stir welding (FSW). The effect of the variation of the translational velocity on the material flow and the equivalent plastic strain are also studied. Results show that the material in front of the pin moves upward due to the extrusion of the pin and is forced to rotate around the pin and then, the material behind the pin is forced to move downward, which makes the friction stir process continuing. A good correlation between the equivalent plastic strain and the microstructure zones is found. With the increase of the translation velocity of the pin, the flow of the material in friction stir welding becomes faster but the equivalent plastic strain decreases. The lower translational velocity can improve the coalescence of the welded plates.

Keywords: friction stir welding material flow finite element equivalent plastic strain microstructure

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