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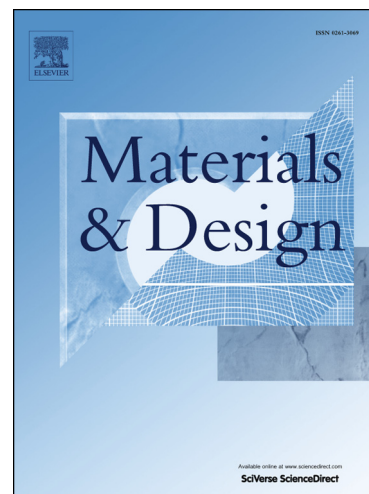
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## Material flow and thermo-mechanical conditions during Friction Stir Welding of polymers: literature review, experimental results and empirical analysis

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### Abstract

Meanwhile the thermo-mechanical conditions during Friction Stir Welding (FSW) of metals have already been subject of extensive analysis and thoroughly discussed in literature, in which concerns the FSW of polymers, the information regarding this subject is still very scarce. In this work, an analysis of the material flow and thermo-mechanical phenomena taking place during FSW of polymers is performed. The analysis is based on a literature review and on the examination of friction stir welds, produced under varied FSW conditions, on polymethyl methacrylate (PMMA). Due to the high transparency of this polymer, it was possible to analyse easily the morphological changes induced by the welding process on it. Results of the weld morphologic analysis, of the residual stress fields in the different weld zones and of temperature measurements during welding are shown, and its relation with welding conditions is discussed. From the study it was possible to conclude that, due to the polymers rheological and physical properties, the thermo-mechanical conditions during FSW are very different from that registered during welding of metals, leading to completely different material flow mechanisms and weld defect morphologies.

**Keywords:** Friction Stir Welding; Polymers; PMMA; Morphology; Residual stresses; Temperature

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