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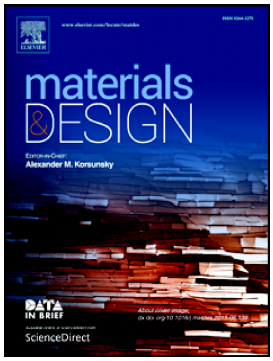

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ACCEPTED MANUSCRIPT

Enhanced multiscale modeling of macroscopic and microscopic residual stresses evolution during multi-thermo-mechanical processes

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Abstract

After several decades, it is still difficult to predict "macroscopic and microscopic (M-m)" residual stresses (RSes) in metal matrix composites (MMCs) after welding. In this work, an enhanced multiscale model is developed to predict the evolution of M-m RSes in MMCs during several thermo-mechanical processes including welding. This multiscale model is capable of handling non-zero initial M-m RSes and integrates the temperature history dependent constitutive model (THDCM) at both macroscale and microscale. Meanwhile, thermal source model of friction stir welding (FSW) is integrated. The extension to other welding thermal source is straightforward. This multiscale model is used to study the generation, inheritance, and evolution of M-m RSes in a SiC/Al composite during quenching, FSW and post-welding heat treatment (PWHT). The effects of initial M-m RSes and material constitutive models on the prediction of M-m RSes are systematically assessed. It is found that using the THDCM and taking into account the initial RSes, this multiscale model shows

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