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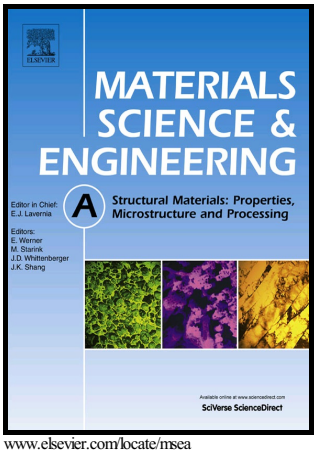

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Development of bulk ultrafine grained Al- SiC nano composite sheets by a SPD based hybrid process: experimental and theoretical studies

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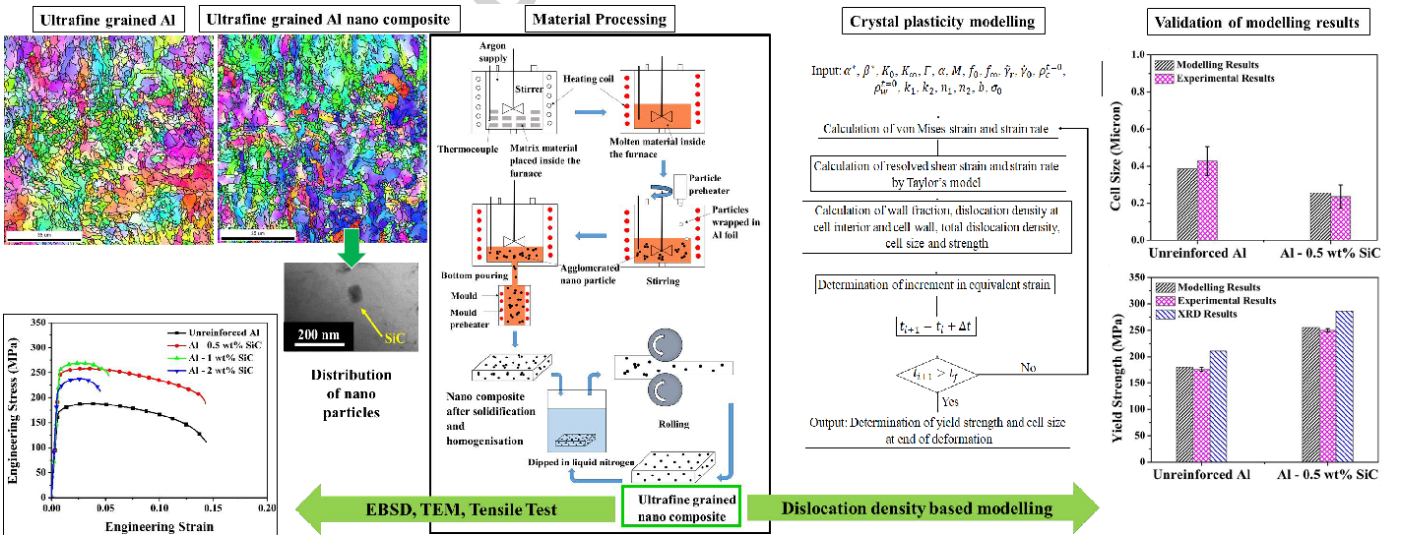
Abstract

In the present work, a hybrid manufacturing route, combining stir casting with cryorolling, is proposed for production of Ultrafine grained (UFG) nano composite sheets using an Al 1050 matrix in combination with β-SiC particles (0.5 wt %, 1 wt %, 2 wt %). The method provides the scope for generating UFG microstructures with homogeneous distributions of nano particles that are difficult to achieve with current manufacturing routes. The influence of the nano SiC reinforcement on the mechanical properties of the UFG nano composites were studied with an emphasis on the characterization of the microstructure. The results show that with an increasing content of reinforcement, the degree of grain refinement and strength of the UFG nano composite increases while the ductility reduces. The microstructural information and the obtained yield strengths of the UFG nano composites were validated with a mathematical model. For this, an existing dislocation density based model was modified to account for the effect of nano reinforcement and processing parameters.

Graphical abstract



Keywords: Ultrafine grained, nano composites, cryo-deformation, strength, ductility, strain hardening, crystal plasticity.