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Hot deformation mechanisms and microstructure evolution of SiCp/2014Al composite

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Abstract:

Hot deformation behavior of a stir cast and hot extruded 14 vol.% SiCp/2014Al composite was studied at temperatures from 355 to 495 °C and strain rates from 0.001 to 1 s⁻¹, including microstructure evolution and damage formation. Stress-strain rate fitting was optimized to construct accurate processing maps based on modified dynamic materials model (MDMM). In addition, the strain rate sensitivity maps were plotted, indicating more significant effect of temperature on deformation mechanism than strain rate. The dissipation efficiency versus temperature curves indicated: (i) a transition from dynamic recovery (DRV) to dynamic recrystallization (DRX) at 400 °C; (ii) occurrence of dynamic grain growth (DGG) at 400-440 °C; (iii) existence of equicohesive point (T_{eq}) of 450 °C ($\sim 0.8 T_m$) above which grain boundaries weakened and contributed to plastic deformation. The particular fluctuation of temperature sensitivity at 440 °C was caused by an abnormal grain growth.

Keywords: Metal matrix composites; Hot deformation; Processing map; Dynamic recovery; Dynamic recrystallization

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