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Neutron diffraction study of the in-situ tension deformation behaviour of SiCp/Mg-Zn composite

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The work hardening and softening behaviour of SiCp/Mg-5Zn composites influenced by PDZ (particle deformation zone) size were analysed and discussed using neutron diffraction experiment under in-situ tensile deformation at STRESS-SPEC. Peak broadening evolution was interpreted as the modification of dislocation density, which discovered the effect of dislocation on the work hardening behaviour of the composite. For this study, three kinds of PDZ of 5μm, 10 μm, 20 um SiCp/Mg-5Zn composites were fabricated by semi-solid stirring assisted ultrasonic treatment method. The unique tension rig at STRESS-SPEC was used for this at room temperature.
The results show that the work hardening rate of SiCp/Mg-5Zn composites increased with the enlargement of PDZ size, which was attributed to the grain size of SiCp/Mg-5Zn composites increased with the enlargement of PDZ size. Moreover, the stress reduction (ΔPi) values increased continuously during in-situ tensile for SiCp/Mg-5Zn composites due to the stored energy produced during plastic deformation increased, which provided a driving force for the softening effect. The stress reduction (ΔPi) values produced by the softening effect of SiCp/Mg-5Zn composites are affected by the grain size and stored energy produced during in-situ tensile deformation. However, the role of the grain size of SiCp/Mg-5Zn composite on the softening effect is greater than the stored energy.

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