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# 粗大第二相及时效析出相对Al-Mg-Si合金延性断裂的耦合影响

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摘 要： 针对Al-Mg-Si合金采用不同固溶处理和时效处理获得粗大第二相颗粒与析出相颗粒之间体积分数的相对变化，研究粗大第二相颗粒与析出相颗粒对合金断裂应变的耦合影响。结果表明：两种颗粒间含量的相对变化对Al-Mg-Si合金断裂应变的影响呈非单调性，粗大第二相颗粒含量较高的合金经较高温度时效时，其断裂应变值高于粗大第二相含量较低但经较低温度时效的合金的断裂应变值。根据强韧化效果相对变化对此试验现象进行分析讨论，采用多尺度断裂模型很好地模拟了该两相颗粒对断裂应变的耦合影响。

关键字： Al-Mg-Si合金；第二相；析出相；断裂应变

# Coupled influence of constituents and precipitates on ductile fracture of Al-Mg-Si alloys

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**Abstract:** Different solution, quenching and aging treatments, inducing a trade-off between the constituents and precipitates, were employed to Al-Mg-Si alloys in order to study the coupling effect of the trade-off in volume fraction on the fracture strain. The results show that the dependence of ductility on the trade-off in volume fraction between the constituents and precipitates is non-monotonic, and that the alloys containing more detrimental constituents but aged at a somewhat higher temperature exhibit ductility superior to those of the alloys containing less detrimental constituents but aged at lower

temperature. The experimental phenomena above are analyzed according to the change-over in strength and toughness, furthermore, the coupling effect of the constituents and precipitates on the strain to fracture is well modeled by using multi-scale model.

**Key words:** Al-Mg-Si alloy; constituent; precipitate; fracture strain



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