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6061-T6铝合金单轴时间相关循环变形行为

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摘要:对6061-T6铝合金进行系统的单轴应变循环和应力循环实验, 揭示该材料在室温和高温下的循环变形行为, 讨论环境温度、加载速率、峰/谷值保持对其应变循环特性及棘轮行为的影响。结果表明, 6061-T6铝合金表现出弱的循环软化特性, 其棘轮行为不仅依赖于平均应力和应力幅值的大小, 还依赖于加载历史。尽管该合金的单拉行为对应变率的变化不敏感, 但其循环变形行为却体现出明显的时间相关特性, 即: 应变循环下, 在峰/谷值有保持时的响应应力幅值明显小于没有保持时的值, 且随着保持时间的增加, 响应应力幅值将进一步减小; 应力循环下, 在峰值有保持时产生的棘轮应变比没有保持时的值大, 且随着峰值保持时间的增加及应力率的降低, 棘轮应变明显增大。

关键字: 6061-T6铝合金; 循环载荷; 棘轮行为; 时间相关

Uniaxial time-dependent cyclic deformation of 6061-T6 aluminium alloy

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Abstract: A series of experiments were carried out under uniaxial cyclic straining and cyclic stressing to observe the time-dependent cyclic deformation behaviors of 6061-T6 aluminium alloy at room and elevated temperatures. The main attention was paid to the effects of ambient temperature, loading rate, and peak/valley hold on the strain cyclic characteristics and ratchetting. The results show that 6061-T6 aluminium alloy presents weak cyclic softening feature; the ratchetting behaviour of the material depends not only on the current values of applied mean stress and stress amplitude, but also on their loading histories. Although 6061-T6 aluminium alloy is not sensitive to the variation of strain rate in monotonic tension, its cyclic deformation presents remarkable time-dependence, i.e., the responded stress amplitude in the cyclic straining with peak/valley strain hold is smaller than that obtained without any hold, and decreases further as the hold-time increases; the ratchetting strain produced in the cyclic stressing with peak stress hold is larger than that without any hold and increases as the hold-time increases and the stress rate decreases.

Key words: 6061-T6 aluminium alloy; cyclic loading; ratchetting; time-dependence

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