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研究论文

2024--T3和2524--T34铝合金疲劳裂纹的萌生机制

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摘要： 通过2024--T3和新型2524--T34铝合金的疲劳实验和对试样表面及疲劳断口的观测, 研究了材料的微观结构和疲劳裂纹萌生机制。实验在室温下完成, 应力比为0.1、加载频率为15 Hz。结果表明: 实验材料呈现了再结晶的层状晶粒结构, 晶粒沿着轧制方向被拉长, 并较为平坦。2024铝合金中二相粒子的分布更为密集无序, 且粗大、不规则形状的二相粒子分布更多, 而2524铝合金中二相粒子多沿轧制方向呈带状分布。2524铝合金中的多数裂纹萌生于材料中含Fe的粗大的β相粒子, 并伴有少量的滑移带裂纹形核和材料缺陷裂纹形核等; 包铝层的滑移带形成的挤入挤出为2024和2524包铝合金的裂纹多处形核提供了主要位置。

关键词： 材料科学基础学科 铝合金 二相粒子 疲劳裂纹 裂纹萌生

The Mechanism of Fatigue Crack Initiation of 2024－T3 and 2524－T34 Aluminum Alloys

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Abstract: The microstructure and mechanism of fatigue crack initiation of 2024－T3 and 2524－T34 Al alloys were investigated. Four－point bending and tension －tension fatigue tests on the tested alloys with a frequency of 15 Hz, R=0.1 along the rolling direction were conducted at room temperature. It was found that the flat grain was elongated along the rolling direction, showing the laminar grain structure. The amount of coarse and irregular particles and the density of secondary particles distributed in 2024 were much higher than that in 2524. Particles in 2524 distributed stripped along the rolling direction. The majority of fatigue cracks of 2524 were initiated on the coarse β phase second particle, containing Fe, a few of them formed on sites of material defects or slip bands. The intrusion and extrusion induced by slip band in the Al cladding layer provided principal fatigue crack initiation sites for 2024 and 2524 Al－cladding aluminum alloys.

Keywords: foundational discipline in materials science aluminum alloy the second－phase particle fatigue crack fatigue crack initiation

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