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Zn-40Al合金中微观缺陷和3d电子的正电子湮没

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摘要: 测量Zn单晶、Al单晶、铸态Zn₆₀Al₄₀合金以及冷轧Zn、Al、Zn₆₀Al₄₀的符合正电子湮没辐射多普勒展宽谱和寿命谱。结果表明, 单晶Zn和铸态Zn₆₀Al₄₀合金的商谱在约 $17.4 \times 10^{-3} m_0c$ 处出现一个峰, 主要是正电子与Zn中3d电子湮没的作用; 当Zn原子和Al原子形成Zn₆₀Al₄₀合金时, Zn原子和Al原子间主要以金属键结合; 轧制Al的商谱明显低于单晶Al的商谱, 冷轧Zn₆₀Al₄₀合金商谱略低于铸态Zn₆₀Al₄₀合金商谱; 而单晶Zn和轧制Zn的商谱几乎重叠; Al、Zn金属和Zn₆₀Al₄₀合金经冷轧后, 由于样品中产生了缺陷, 而导致正电子平均寿命增加, 轧制Al的增幅最大, 轧制Zn₆₀Al₄₀合金的增幅次之, 而轧制Zn的增幅最小。

关键字: Zn₆₀Al₄₀合金; 3d电子; 微观缺陷; 正电子湮没

Positron annihilation of microdefects and 3d electrons in Zn-40Al alloy

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Abstract: The coincidence Doppler broadening spectra and positron lifetime were measured in single crystals of Al, Zn, as-cast Zn₆₀Al₄₀, and cold-rolled Al, Zn, Zn₆₀Al₄₀. The results show that there is a peak at about $17.4 \times 10^{-3} m_0c$ in the ratio curves of the single crystal of Zn and the as-cast Zn₆₀Al₄₀ alloy, and it is due to the contribution of positron annihilation with 3d electrons of Zn atoms. The bonding nature in a Zn₆₀Al₄₀ alloy is metallic when Zn and Al atoms combine to form the alloy. The ratio curve of cold-rolled Al is obviously lower than that of the single crystal Al, and the ratio curve of cold-rolled

$Zn_{60}Al_4$ is slightly lower than that of the as-cast $Zn_{60}Al_{40}$, while the ratio curve of cold-rolled Zn is almost super-imposed with that of the single crystal Zn. The microdefects in Al, Zn and $Zn_{60}Al_{40}$ are introduced after these samples are cold-rolled, which gives rise to the increase of positron lifetime. The magnitude of lifetime of cold-rolled Al is the largest, that of the cold-rolled $Zn_{60}Al_{40}$ is the second and that of the cold-rolled Zn is the smallest.

Key words: $Zn_{60}Al_{40}$ alloy; 3d electrons; microdefects; positron annihilation

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