激光材料和光学元件

基片衍射时原子速率对激光汇聚铬原子沉积的影响

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摘要：

为了研究基片衍射对激光汇聚原子沉积的影响,基于标量光学衍射理论,采用数值计算对比分析了基片衍射与否两种情况下,铬原子波包几率密度分布(表征了沉积条纹)特征值随原子波包速率的变化。结果表明,当原子波包横向速率保持不变、而纵向最可几速率在考察范围内变化时,基片衍射会使波包几率分布的最大值平均约有14.9%的增加量,而半峰全宽平均约有14.3%的减小量;当原子波包纵向最可几速率保持不变、而横向速率在考察范围内变化时,基片衍射会使波包几率密度分布的最大值平均约有14.5%的增加量,而半峰全宽平均约有16.9%的减小量。该研究成果为实验提供了有益的理论指导。

关键词： 激光技术　基片衍射　原子波包　光学势阱

Effect of atomic velocity at substrate diffraction on laser-focused Cr atom deposition

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Abstract:

In order to study the effect of substrate diffraction on laser-focused Cr atom deposition, simulation and comparative analysis were performed based on the scalar optical diffraction theory under the presence and absence of substrate diffraction. The variation of stripe value of atomic wave-packet probability distribution which stands for the deposited lines with different atomic wave-packet velocities was focused. The results show that because of substrate diffraction, the max value of wave-packet probability distribution has 14.9% average increase and the full width of half maximum (FWHM) has 14.3% average decrease for different longitudinal most probable velocities when transverse velocity remains constant; the max value of wave-packet probability distribution has 14.5% average increase and the FWHM has 16.9% average decrease for different transverse velocities when the most probable longitudinal velocity remains constant. The research results provide a richer theoretical guidance for the experiment.

Keywords: laser technique　substrate diffraction　atomic wave-packet　optical potential

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