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亚波长金属光栅结构的制备与矢量衍射理论分析

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摘要： 利用纳米压印结合溅射和反应离子刻蚀工艺制备了周期为1 μm、占空比为0.2的亚波长金属光栅,利用紫外-可见-近红外光谱仪测量了光栅的0级反射光谱。在严格耦合波分析的基础上,把光栅区域电磁场的空间谱波通过勒让德多项式展开,使用多项式展开的谱分析法求解常微分方程,计算了该亚波长金属光栅的反射光谱及磁场分布。实验测量结果同矢量衍射理论计算结果都显示,该光栅在近红外、中红外波段具有表面等离子体共振现象。数值计算结果还表明,对于此类亚波长金属光栅,当光栅的深宽比增加时,其反射光谱中会出现更多的反射谷。

关键词： 亚波长金属光栅 纳米压印 表面等离子体

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Fabrication of Subwavelength Metal Grating and Analysis with Vector Diffraction Theory

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Abstract: We fabricated a subwavelength metallic grating using nanoimprint technology and measured the reflection spectrum using ultraviolet-visible-near-infrared spectrophotometer. Based on the theory of conventional rigorous coupled wave analysis, we used a new method to analyze the diffraction problems of subwavelength metallic gratings. We used fast Fourier factorization (FFF) method to derive the coupled wave equations, then each space harmonic can be expanded in terms of Legendre polynomials in grating region. Using this modified vector diffraction theory, we calculated the diffraction efficiency and the field distribution. All calculated results show great agreement with the experimental results.

Keywords: subwavelength metallic gratings nanoimprint surface plasmon

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