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微纳技术与精密机械

纯金膜表面等离子增强的旋光效应

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摘要： 为了研究棱镜的磁光特性对系统光学响应的影响,测试了单个BK7棱镜在全内反射条件下的旋光角度谱以及BK7棱镜与金膜组合构成Kretschmann结构的旋光角度谱,并根据传统光学理论分析了光谱的成因。理论分析结果表明:在单个BK7棱镜构成的全内反射结构中,棱镜底部对p波和s波产生的反射系数差异是导致系统进入全内反射临界角之前产生较强旋光效应的主要原因;在BK7棱镜与金膜组合构成的Kretschmann结构中,棱镜的磁光特性使得光波到达金膜表面之前产生了较小的s光分量,金膜表面等离子共振激发削弱了p光振幅,两种因素结合产生了一种新的表面等离子共振增强磁光效应的物理机制。实验结果表明:Kretschmann模式下,26 nm厚金膜的表面旋光角最大为1.7°，克服了传统磁光克尔效应响应较弱的缺点。

关键词： 表面等离子增强 表面等离子共振 磁光效应 磁光棱镜 Kretschmann结构

Plasmon enhanced magneto-optical effect on surface of pure gold film

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Abstract: To investigate the influence of Magneto Optical(MO) properties of a prism on systematic optical response, the MO spectra of a single BK7 prism under the condition of total internal reflection was measured, and the spectra of Kretschmann configuration composed of the BK7 prism and a gold film was measured also. Then, based on the framework of traditional optical theory, the reasons of these spectra were analyzed explicitly. The theoretical results show that under conditions of total internal reflection, the Kerr rotation of the single BK7 prism increases significantly before the system gets in the critical angle, and the phenomenon comes from the different reflection coefficients between p and s waves. When the BK7 prism with the gold film is combined to form a standard Kretschmann configuration, a huge enhancement of Kerr rotation appears at the resonance angle due to the MO capability of BK7 material and the conversion of incident p-polarized wave to surface plasmons. The maximal experimental polar Kerr rotation of the gold film (26 nm) is 1.7?, which overcomes the disadvantage of poor response in the traditional way.

Keywords: surface plasmons enhancement Surface Plasmon Resonance (SPR) magneto-optical effects magneto-optical prism Kretschmann configuration

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