

论文

金属-电介质多层膜结构亚波长成像特性分析

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摘要:

分析了由Ag和Si3N4多层纳米薄膜组成的特异材料的模式特性, 使用本征模展开法(EME)结合完全匹配层(PML)边界条件模拟了该结构的亚波长成像行为, 在法布里-珀罗(Fabry-Perot)条件(结构的长度是半波长的整数倍)条件下, 研究发现邻近系统的点源会在另一侧成实像, 这种成像基于自准直而并不是负折射. 研究结果证实了金属-电介质多层膜结构可以在光波段实现近场成像.

关键词: 亚波长成像 自准直 金属-电介质多层膜 本征模展开法

Subwavelength Imaging Properties of Multilayered Metallodielectric Nanofilms

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Abstract:

The characteristics of a metamaterial consisting of multilayered Ag/Si3N4 nanofilms are studied and the eigen mode expansion (EME) method is used to demonstrate the subwavelength imaging effect. A point source placed in the vicinity of the structure can form a image in the opposite side of the slab, the impedance match is not necessary since the Fabry-Perot condition is fulfilled (the thickness of the structure is an integer number of half-wavelengths) and the reflections from the interfaces are almost eliminated. The subwavelength imaging effect in this structure based on the self-collimation but not the negative refraction. This structure verifies that the use of one-dimensional metallodielectric (1D-MD) structure is a very prospective way of extending the use of near-field enhancement phenomenon into the optical region.

Keywords: Subwavelength imaging Self-collimation Metallodielectric nanofilms Eigen-mode expansion method

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