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基于二维金属亚波长孔阵列结构的MEMS红外辐射源特性研究

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摘　要：

本文以MEMS红外气敏传感器为应用目标，采用MEMS技术设计和制作一种基于二维金属亚波长孔阵列结构的红外辐射源。探讨了不同厚度SU-8膜对金属/ 电介质/ 金属（M/ D/M）二维金属亚波长孔阵列结构在中远红外（2~14微米）波段透射特性的影响。设计并制作了Au/SU-8/Au的M/D/M结构，其中金属膜Au的厚度为20纳米，控制在趋肤深度以内，SU-8膜的厚度从0.2微米到1.2微米。采用傅里叶变换红外光谱仪器测试了该二维金属亚波长孔阵列结构的透射特性。同时本文应用FDTD软件R-soft，对M/ D/M结构的中远红外波段透射特性进行了模拟，被模拟的结构中的电介质包括SiO2、Si3N4、SiOxNy、SU-8等。实验结果表明，SU-8厚度在小于1微米时，透射强度远大于厚度1微米以上的结构，且有透射强度最大值出现（SU-8厚度为360纳米），同时，随着SU-8厚度的增加，透射谱峰值呈现规律性红移。研究结果同时表明采用FDTD数值模拟软件R-soft的结果与实验相符。

关键词：二维金属亚波长孔阵列结构；SU-8膜的厚度； 透射增强特性

The Reseach of MEMS Infrared Radiation Source Characteristics Based on Two-dimensional Metallic Sub-wavelength Hole Arrays

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Abstract:

in this work, a novel tunable narrow-band infrared emitter based on two-dimensional metallic sub-wavelength hole arrays is reported and the relationship between the transmission spectrum of the emitter and the thickness of SU-8 layer of metal/dielectric/metal(M/D/M) structure in mid-infrared waveband(2~14 micron) has been studied. The emitter is structured by Au/SU-8/Au, which the thickness of Au layer is 20nm, and the SU-8 layer is between 0.2 to 1.2 micron. The transmission spectrum has been tested out with Varian 4100 FT-IR. The experimental data has been compared and analyzed with simulation results from finite-difference time-domain(FDTD) calculation. It is found out that the structure with SU-8 layer thinner than 1 micron has much larger transmission peak strength than the ones with thicker SU-8 layer, with the largest transmission peak strength found when the thickness of SU-8 layer is 360nm., and the red-shift of the wavelength of the transmission peak is also observed.

Keywords: two-dimensional metallic sub-wavelength hole arrays ; SU-8 layer thickness; transmission.

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