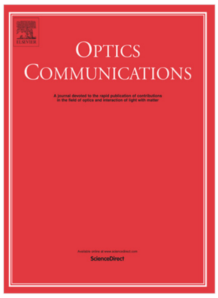
Accepted Manuscript



An approach for calculating arbitrary-order diffraction through hole-array based on thin microcavity theory

Xu Chen, Jiu Hui Wu, Pei Cao

PII: S0030-4018(18)30867-8
DOI: https://doi.org/10.1016/j.optcom.2018.09.078
Reference: OPTICS 23517

To appear in: *Optics Communications*

Received date : 31 July 2018
Revised date : 22 September 2018
Accepted date : 30 September 2018

An approach for calculating arbitrary-order diffraction through hole-array based on thin microcavity theory

Xu Chen[1,2]*, Jiu Hui Wu[1,2]*, Pei Cao[1,2]

1 School of Mechanical Engineering, Xi'an Jiaotong University, Xi'an 710049, China

2 State Key Laboratory for Strength and Vibration of Mechanical Structures, Xi'an Jiaotong University, Xi'an 710049, China

**Corresponding author: ejhwu@mail.xjtu.edu.cn*

An approach for calculating the optical diffraction coefficients through a subwavelength hole-array embedded in a suspending thin metal layer is investigated based on the rigorous coupled wave analysis method and thin microcavity theory. In this approach, the electromagnetic field components in the reflected and transmitted regions and diffraction coefficients of arbitrary orders are derived, respectively, and some enhanced diffraction phenomena are discussed in detail, which are then verified via finite element (FE) simulation. Subsequently, the effects of structural and material parameters of holey thin film including film material, incident angle, hole geometry, and duty cycle of periodic array layer on the transmittance are analyzed. The relevant results show that the duty cycle is the main influence factor, and with the suitable duty cycle the optical transmittance through the free-standing metal layer can be enhanced as high as 0.8 in the visible region. All these findings may be utilized in the wavelength tuning of subwavelength optics.

Key words: subwavelength hole array; thin films; rigorous coupled wave analysis; extraordinary optical transmission; thin microcavity theory