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Title:Reflection and color characteristics of tri-layer metal-dielectric structures for generation of distinctive color shifts
Authors:Chen, Yongli (1); Liu, Wenxia (1)
Author affiliation:(1) College of Packaging and Printing Engineering, Tianjin University of Science and Technology, Tianjin 300222, China; (2) Center for THz Waves, College of Precision Instrument and Optoelectronics Engineering, Tianjin University, Tianjin 300072, China
Corresponding author:Chen, Y.(bit_ylchen@126.com)
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Abstract:Optically resonant behaviors in reflection and relative color characteristics of tri-layered structures consisting of two metal layers spaced by dielectrics embedded in dielectrics are systematically studied. The effects of material and geometrical parameters of the structure on its resonance and color are rigorously simulated. For achieving better reflection resonance and color aspect, specific requirements of choosing metal materials, i.e. with the ratio of real part of refractive indices to its imaginary part between 0.5 and 1.0, must first be satisfied. For the structure, its spectral response and color effect are mainly adjusted by thickness and refractive index of middle dielectric layers. Moreover, two security devices with novel color shifts are fabricated, their design principle and color shifts with angle of observation also are verified. This study has significant value for color-based security and image reproduction of structural colors. 
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Controlled terms:Aspect ratio - Dielectric materials - Metals - Reflection - Refractive index
Uncontrolled terms:Color characteristics - Color effects - Color shifts - Design Principles - Dielectric layer - Effects of materials - Image reproduction - Imaginary parts - Metal layer - Metal materials - Metal-dielectric structures - Real part - Reflection resonance - Relative color - Resonant behavior - Security devices - Spectral response - Structural color
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