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Experimental and numerical confirmation of composite diffracted evasnescent-wave (CDEW) model for enhanced transmission of subwavelength apertures HENRI J. LEZEC, Caltech, Pasadena CA, and CNRS, Paris, France, TINEKE THIO, Arinna LLC — When a subwavelength aperture in an opaque film is surrounded by periodic surface corrugations, its optical transmission can be enhanced or suppressed with respect to that of an identical aperture without surface corrugations. We have proposed a model in which the subwavelength surface structure scatters the incident light into evanescent waves: The total, or composite, diffracted evanescent waves (CDEWs) travel along the surface and their interference with the light directly falling on the aperture leads to the transmission modulation. The CDEW model is valid for metallic as well as non-metallic surfaces, and thus differs qualitatively from the surface plasmon model, which requires a metallic surface. We show that the optical transmission of an embedded periodic array of dots, where the surface is absent altogether, is related to the transmission of hole arrays by Babinets principle, underscoring the importance of diffraction. Furthermore, numerical calculations on small- area corrugations verify the functional form of the CDEWs.

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