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Photo-imprinted diffraction gratings for controlling terahertz radiation.[1] IOANNIS CHATZAKIS, Ames Lab-U.S. DOE, Iowa State Univ. and Material science Stanford Univ, PHILIPPE TASSIN, LIANG LUO, NIAN-HAI SHEN, LEI ZHANG, JIGANG WANG, THOMAS KOSCHNY, Ames Lab-U.S. DOE and Iowa State Univ., COSTAS M. SOUKOULIS, Ames Lab-U.S. DOE, Iowa State Univ. and Found. of Res. and Techn.-Hellas (FORTH) — We investigate the diffraction of terahertz radiation by photo-imprinted conductive periodic structures. The diffraction gratings are created by optically projecting the image of a metal mask on a high-resistivity GaAs substrate, resulting in a periodic structure of photo-excited charge carriers that scatter terahertz waves. Using terahertz time domain spectroscopy, we show that the terahertz transmission spectra depend characteristically on the lattice constant of the photo-imprinted linear gratings and on the polarization state of the incident terahertz wave, but the transmitted radiation does not depend on the duty cycle of the projected gratings. These experimental results, combined with computer simulations of the structure, confirm that the gratings are purely diffraction-based and are not caused by surface modes or quasistatic resonances. We also demonstrate two-dimensional photo-imprinted diffraction gratings. We anticipate that our findings will have significant impact on the development of reconfigurable components for controlling the terahertz radiation.

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