Fabrication of Terahertz Holograms

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A range of holograms for Terahertz radiation have been fabricated in polypropylene. Holograms are designed using the Gershberg-Saxton algorithm and then written on Photolithographic maskplates. From these silicon masters have been fabricated in silicon using a binary fabrication technique. To achieve the deep high aspect ratio structures necessary for Terahertz diffractive optics, SU8 multistage lithography was used combined with ICP RIE. This enables the production of structures with eight phase levels which gives a high diffraction efficiency. To attain high transmission and low Fresnel losses these masters are then used to create the final optics by imprinting into polypropylene. 25 mm x 25 mm holograms with features as small as 25 μm and 100 μm depth are demonstrated.

The technique developed enables the production of any desired terahertz hologram. To illustrate this, lenses (Fig. 1), focal point arrays and pattern generators (Fig. 2) have been produced. We will present results on the fabrication techniques we have developed to make the required structures and data taken from the devices using a 2 THz quantum cascade laser as a radiation source.

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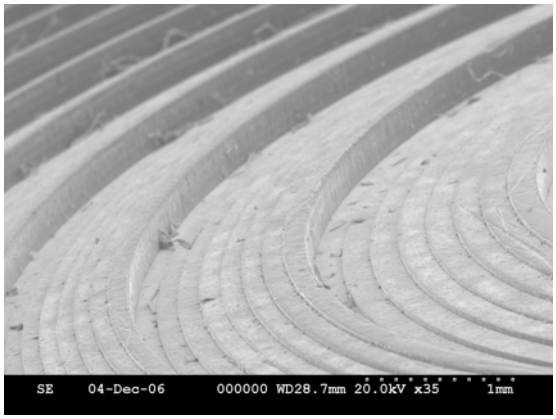
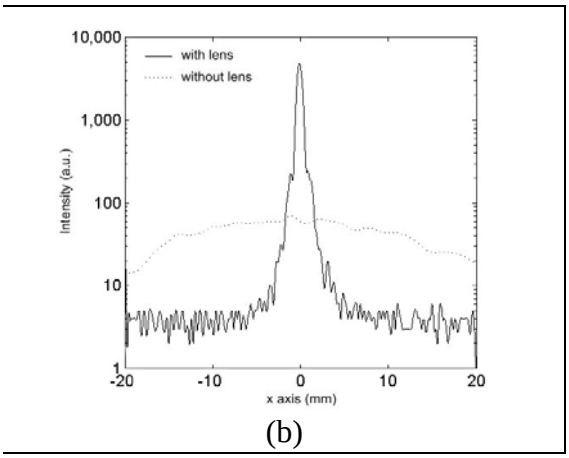


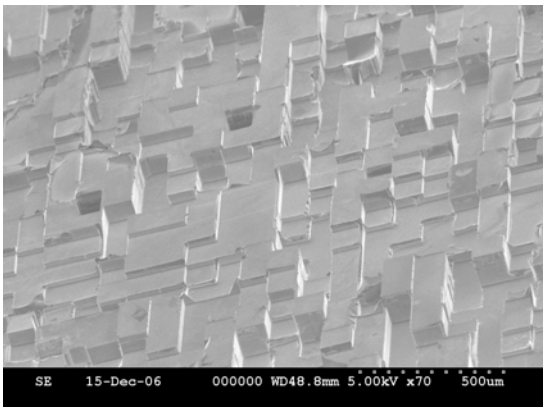
(a)



(b)

Figure 1. (a) a Fresnel zone-plate for use at 2 THz made by imprinting into polypropylene and (b) the resultant beam profile at focus when tested with a quantum cascade laser.

(a)



(b)

Figure 2. (a) an arbitrary pattern, in this case the University of Glasgow crest and logo-type, and (b) the resultant 8-level hologram for use at 2 THz imprinted into polypropylene.