Scalable Metal Mesh Filters for Low Cost THz applications

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Metalmaterial structures are useful for controlling and manipulating THz waves [1]. Among various types of metamaterial-based THz devices, metal mesh bandpass filters have been widely used [2]. In this paper we investigate conventional and trapped mode cross-shaped metal mesh filters on thick 525 μm fused sillica substrates, which are designed so that they can be scaled to operate throughout the THz band. The use of a substrate means that devices are manufactured by sputter coating the metal layers, then the desired filter pattern is defined by standard photolithography and a wet etch of the metal to realise this pattern within the metal. This process enables us to create geometries that are impossible with the conventional self-supporting metal mesh filters, i.e. crosses within crosses, with no additional supporting structures. Furthermore, since all designs are based on standard 525 μm wafer used in 100mm processing there is no needto thin the wafer during fabrication or use more expenisve thinner wafers.

Conventional cross-shaped filters suffer from Fabry–Pérot resonances within the thick substrate. To reduce the effect of these unwanted resonances, and increase the amount of out-of-band rejection above the resonance frequency, a smaller metal cross is placed within the conventional metal cross filter which creates trapped mode excitations, thereby increasing out-of-band rejection. Measurements have been undertaken with Teraview THz-TDS system, which confirm these predictions.

References

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