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"Macroporous Silicon as an IR Filter"

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Currently, optical cutoff filters in the infrared range are primarily based on
scattering or multilayers. These types of filters, however, come with disadvantages.
In multilayer filters the varying material properties between the different layers causes
mechanical instability at extreme temperatures. Scattering-type filters can be very fragile; the filters may be damaged by
exposing them to high pressure gradients or by accidental mechanical removal of the scatterers.
It has recently been found that
macroporous Silicon can act as an optical cutoff filter in the infrared range.[1] Filters constructed from porous
Silicon do not exhibit the same disadvantages as do the scattering and multilayer filters.

Macroporous Silicon is created via an electrochemical etching process using an anodic (i.e. the Silicon sample acts as the anode) electrochemical cell containing an electrolyte solution of hydrofluoric acid and ethanol. When a current is passed across the cell, it is observed that pores form on the surface of the sample over time.
The morphological properties of these pores seem to differ depending on etching conditions such as the concentration of acid in the electrolyte, the electronic and crystallographic properties of the sample, the current, and the etching time.

The cutoff wavelength of the porous silicon filters appears to be dependent on the morphological properties of the sample.
Silicon samples of differing resistivity and crystal orientation have been etched under various
conditions in order to perform a systematic investigation of the relationship between the optical and morphological properties of porous Silicon filters. The cutoff wavelength of the filter is determined by transmission spectroscopy while the morphological properties are investigated by SEM imaging to extract the pore-to-area density of the samples.

[1] V. Kochergin, and H. Foell, 'Novel Optical Elements Made From Porous Si', Materials Science and Engineering, R 52, (2206) 93-140.

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