MULTI-SPECTRAL FILTER ASSEMBLIES

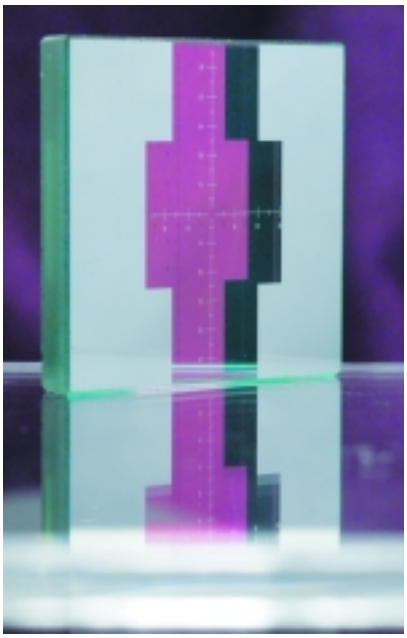
Overview:

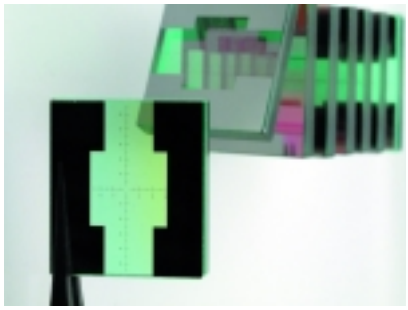
These filter assemblies have been developed by Barr to address a requirement of new multi-spectral sensor systems. The filter wheel has been replaced with multi-band filter arrays mounted directly above the focal plane. Applications range from commercial colorimetry (i.e. paint matching) to Earth imaging (i.e. Landsat)

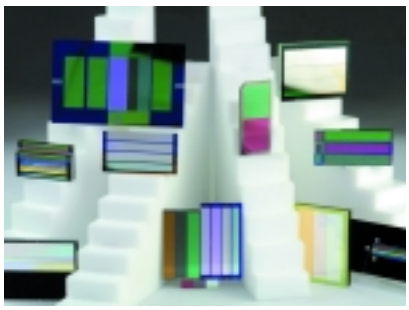
FEATURES

These devices are rugged and reliable offering features like:

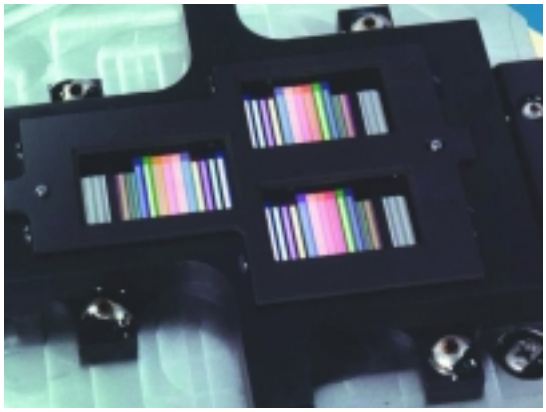
- Many bands in one device (arrays with as many as 15 spectral bands have been delivered).
- Wide spectral coverage (assemblies for UV thru LWIR have been delivered)
- Very fine pitch is routine (bands less than 0.080 mm center-to-center)
- Superior spectral performance (as expected in conventional loose filters)
- Cryogenic or room temperature operation
- Space qualified, flight proven







Barr manufactures reticle filters for commercial defense applications



The photo shows three filter arrays provided by Barr to the MTI program. MTI produced high quality Earth imagery for government and civil entities.

MULTI-SPECTRAL PATTERNED FILTER ARRAYS

Overview:

This technique permits the precise positioning and sizing of multiple filter features on a single substrate. Barr has produced patterned filters for a number of flight instrument programs. High aspect ratio filter strips consistent with current line array detector architectures are possible.

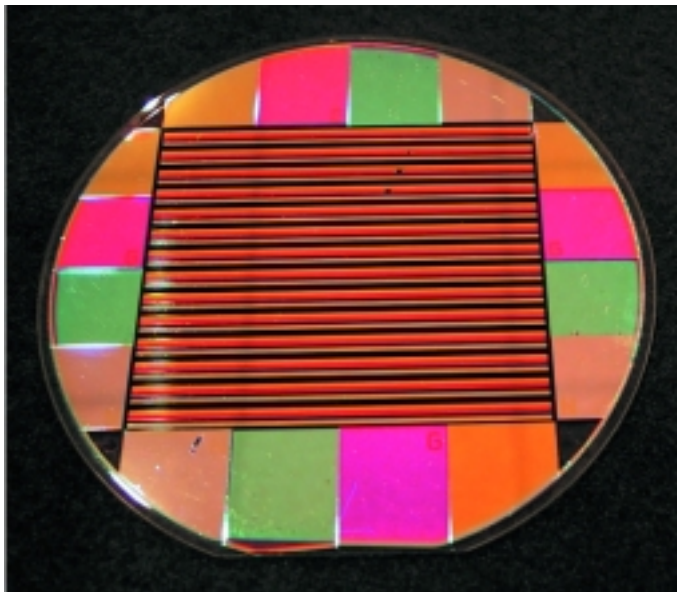
FEATURES

Some of the features of these filters are:

- Very fine, precise filter features as small as a few tens of microns, located within a few microns of the desired position.
- Wavelengths from UV to LWIR have been produced, but single substrate, multi waveband devices are not practical.
- Several filters on a single substrate are possible
- Any feature shape is possible
- Cryogenic or room temperature operation
- Space qualified

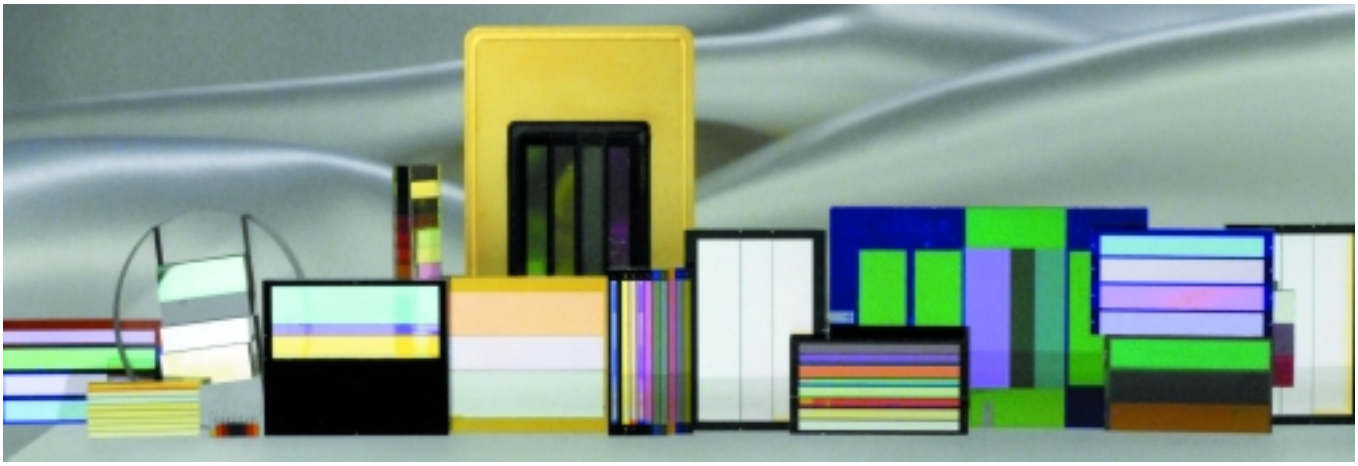
Four-color (VNIR) patterned filter array wafer. Wafer diameter is 100 mm. The wafer shown is from a commercial Earth imaging flight instrument program. The filter arrays are the long rectangular strips centered on the wafer. The surrounding larger filter zones are coupon regions used for testing. Final filter strips and coupons are cut from the wafer using a precision saw to dimensional accuracies in the few micron range.

(Comparison of Filter Assemblies and Patterned Arrays are located on next page)



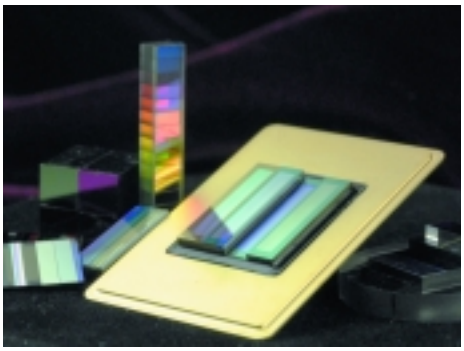
Typical Characteristics

Dimensional	Assemblies	Patterned
Center-to-center element dimension (Typical)	1.000 mm or less	1.000 mm or less
Tolerance	+/- 0.010 mm	+/- 0.010 mm
Cumulative over 6 bands	+/- 0.010 mm	+/- 0.005 mm
Clear Aperture size	+/- 0.005 mm	+/- 0.005 mm
Tolerance	+/- 0.010 mm	+/- 0.005 mm
Dead zone width (as small as)	< 0.075 mm	< 0.050 mm
Adhesive	Opaque epoxy	NA
Mask all dimensions	+/- 0.005 mm	+/- 0.005 mm
Front-to-back alignment, if two masks	+/- 0.020 mm	+/- 0.010 mm
Position wrt fiducial or edge	+/- 0.010 mm	+/- 0.010 mm
Bond line width	0.015 +/- 0.005 mm	NA
Edge chips (fused silica / Si)		
Average	0.020 mm / 0.005 mm	0.020 mm / 0.005 mm
Max	0.035 mm / 0.010 mm	0.035 mm / 0.010 mm
Transmitted WF error over any element (band)	Lambda/8 RMS	Lambda/8 RMS
Wedge, individual element	30 arc sec	30 arc sec
Element-to-element thickness matching	+/- 0.020 mm	NA
Co-planarity, specified surface	+/- 0.010 mm	0
Cutting tolerances (strip widths), if called out	+/- 0.006 mm	NA



Cosmetics	Assemblies	Patterned
Defects, max (VNIR / IR)	0.030 mm / 0.080 mm	0.030 mm / 0.080 mm

Environmental		
Survival temperature range	Cryo to +80 C	Cryo to +200 C
Thermal cycling	100 cycles 80K to 320K	100 cycles 80K to 200 C
Thermal shock	10 cycles, LN2 dunk to 60 C hot plate	same
Radiation	>100 k Rads	same
Humidity	24 hours 65 C, 95 % RH	same
Salt Fog, Salt Solubility, etc.	Per Mil Spec.	same



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