

81 - Multispectral Filter Assemblies, MWIR - LWIR

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ABSTRACT

Multispectral filters arrays have long been a key contributor to earth observation and remote sensing satellites. While there are many options for both monolithic and butcher block configurations readily available in the VIS, NIR and even SWIR wavelength regions. Providing high performance and durable solutions in the MWIR and LWIR regions can be more challenging. Materion Balzers Optics has been a world leader for over 40+ years in providing optical components for a broad range of space applications. Our unique experience here, coupled with our in-house coating, dicing, assembly and qualification capabilities, we offer solutions in the MW & LW regions that are as durable, precise and high performing as those at VIS wavelengths. Whether for institutional TIR earth monitoring, commercial fire monitoring, lunar exploration or even deep space applications, our MW/LW multispectral assemblies offer an improved option over the filter stripes or individual filters typically used for these wavelengths. This paper intends to summarize our current capabilities as well as provide details on continued enhancements.

Keywords: Multispectral, hyperspectral, bandpass filters, earth observation, butcher block assemblies

INTRODUCTION

For over 40 years Materion Balzers Optics has been providing cutting edge Multispectral filter arrays for high end government sponsored programs (Landsat, VIIRs, WorldView, ect..). Working closely and collaborating with our customers over the years we have developed solutions to improve LAS (large angle scatter), ghosting, R%, stray light control and channel to channel cross talk. As well as developing mechanical solutions for stress balancing, opaque masking, dimensional tolerance, and focal length matching. Our broad knowledge and understanding of these challenges give us a unique ability to mitigate and balance those challenges against the economics of the ever-expanding commercial programs. Our range of offerings here include butcher block filter arrays, monolithic multi-band filters, liner variable filters as well as hybrid solutions. Space is no longer exclusively about exploration and science; it has clearly evolved into a commercial enterprise where profit is a key component of success. New methods, technologies and capabilities are required to meet those needs. By combining our experience and understanding of the technical requirements with our in-depth understanding of today's economics MBO can provide solutions that balance both.

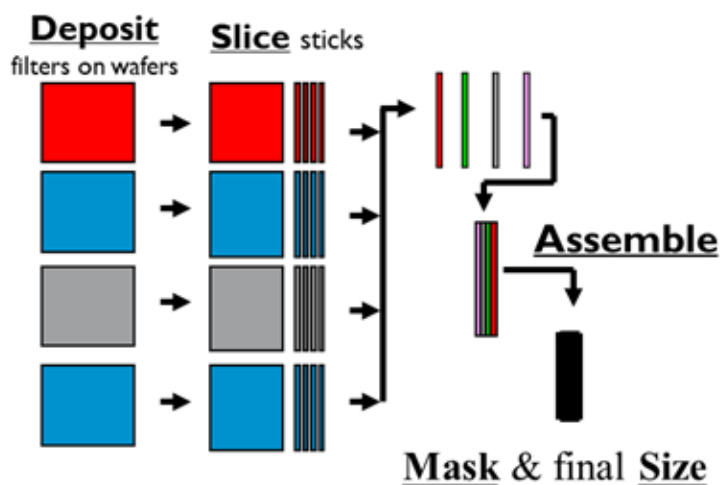
HISTORY

Our history as optical coating providers can be traced back to the 1960's in Europe, as Optics Balzers and the 1970's as Barr Associates. Both companies offered similar solutions with slightly different approaches. Over the years each one expands and improves in-house capabilities while also leveraging technology advancement in contributing technologies. In 2020, Materion (formerly Barr Associates) and Optics Balzers merged into one global entity, Materion Balzers Optics. With over 900 employees, at seven production sites worldwide (Malaysia, Shanghai, Liechtenstein, Jena Germany and Westford MA), Materion Balzers Optics is now one of the largest optical coating manufacturers in the world. Providing optical coating solutions from UV (180nm) through LWIR (20+ μm). Our expertise in optical coating solutions as well as our knowledge and advancements in contributing technologies, such as photolithography, metrology, cleaning & preparation all part of the evolution of our multispectral filter arrays for earth observation.

MWIR & LWIR MULTISPECTRAL ARRAYS

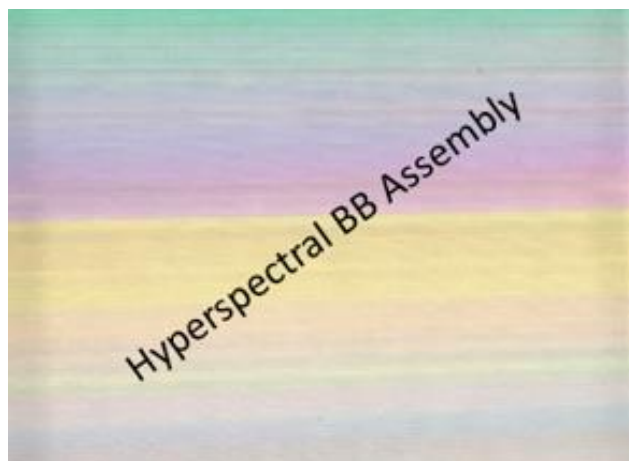
Butcher Block Assemblies

The assembly method we employ for our MWIR – LWIR multispectral filter arrays is what we call our “butcher block” process. We take multiple substrates, coated individually, diced to filter strip size, edge bonded together, dark masking applied. The benefits here are, a nearly unlimited number of bands (> 100 demonstrated), FWHM < 1.0nm, wavelengths from 200nm to 20 μm , edge bonding provides OD5 band-to-band separation, high degree of spectral performance as well as the ability to offer a large variety of substrates (even withing the same assembly). The only real limitation is these must be in linear or checkerboard shape only,

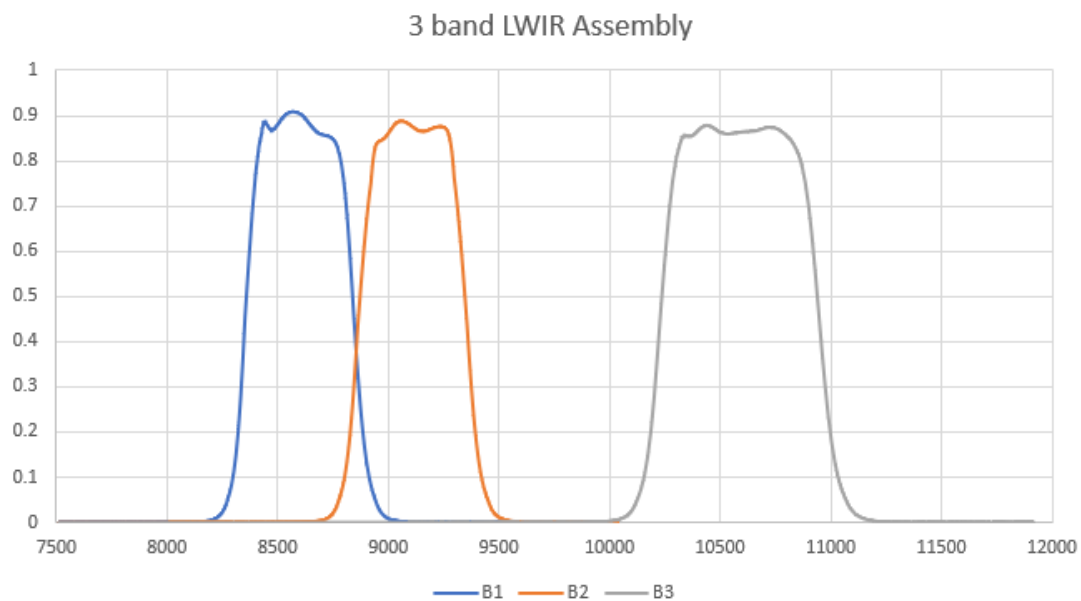


Picture of MWIR butcher block array

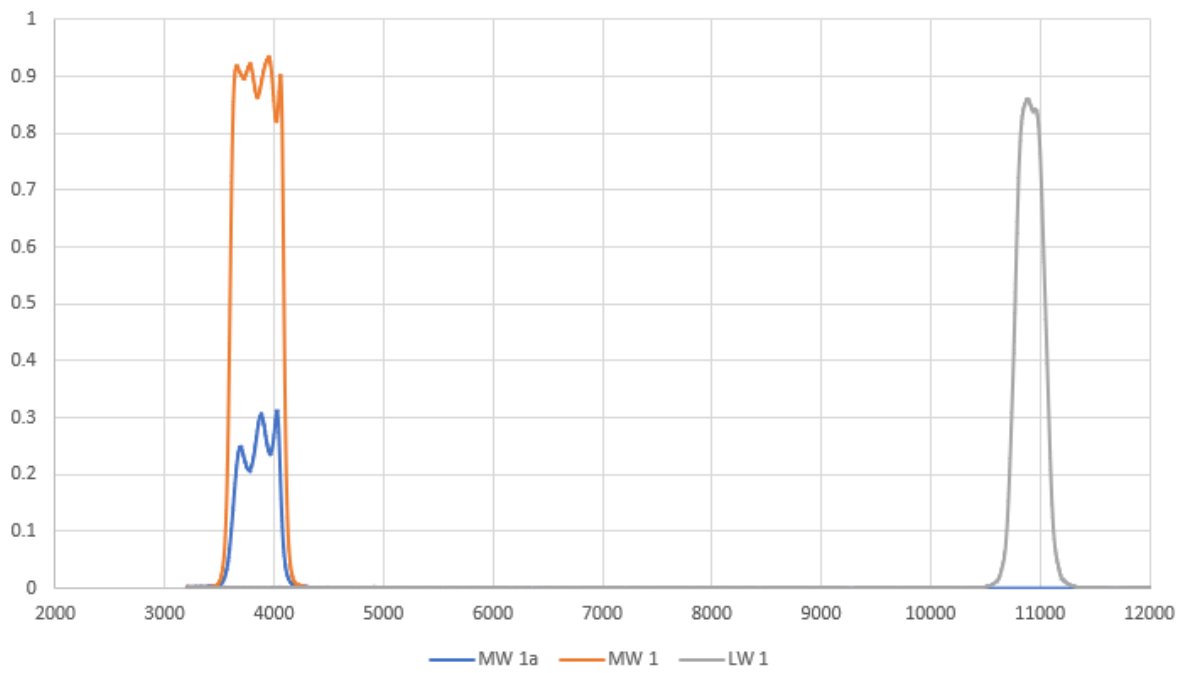
Image of a manufactured MWIR butcher block assembly with 100 individual bands. .



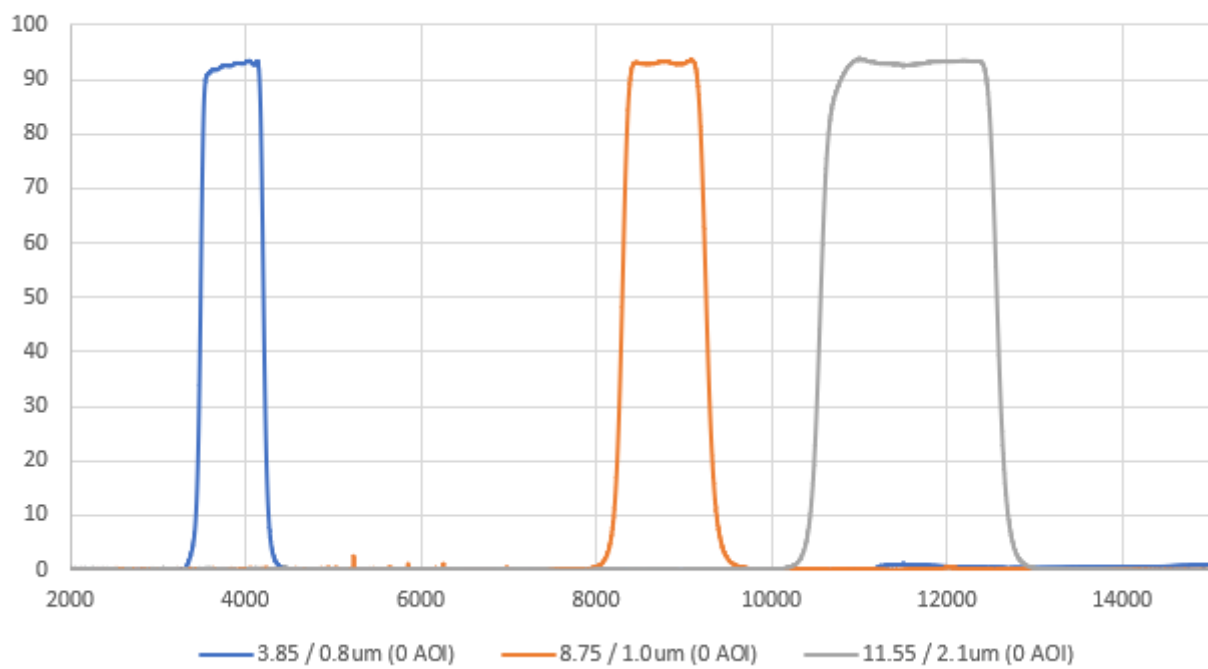
MWIR / LWIR BANDPASS EXAMPLES



3 band MW/LW asm (with attenuated band)



3 band MW/LW - High performance BP designs



POSTER

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Abstract:

Multispectral filters arrays have long been a key contributor to earth observation and remote sensing satellites. While there are many options for both monolithic and butcher block configurations readily available in the VIS, NIR and even SWIR wavelength regions. Providing high performance and durable solutions in the MWIR and LWIR regions can be more challenging. Materion Balzers Optics has been a world leader for over 40+ years in providing optical components for a broad range of space applications. Our unique experience here, coupled with our in-house coating, dicing, assembly and qualification capabilities, we offer solutions in the MW & LW regions that are as durable, precise and high performing as those at VIS wavelengths. Whether for institutional TIR earth monitoring, commercial fire monitoring, lunar exploration or even deep space applications, our MW/LW multispectral assemblies offer an improved option over the filter stripes or individual filters typically used for these wavelengths. This paper intends to summarize our current capabilities as well as provide details on continued enhancements.

Types of Multispectral filter arrays

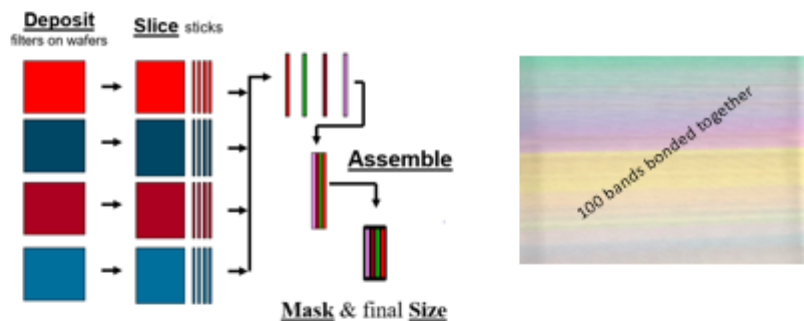
Monolithic Filters

- Single substrate construction

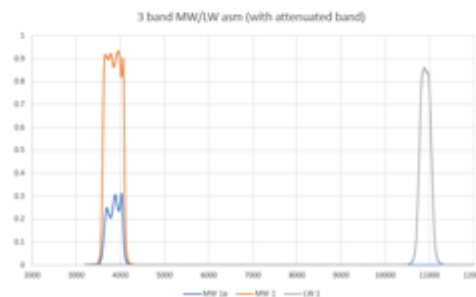
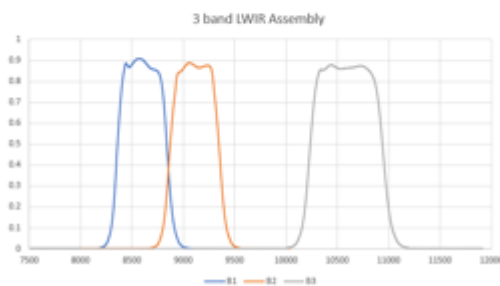


Butcher Block Assemblies

- Multiple substrates bonded together
- Nearly unlimited # of bands



Demonstrated Performance



CONCLUSION

Materion has demonstrated capability of providing complex optical coating in the MWIR _ LWIR wavelength region. These complex filters can then be included in our multispectral filter assemblies offering simultaneous detection of multiple wavelength bands from a single compact assembly. This technology replaces bulky filter wheels with streamlined, high-resolution filter arrays, offering enhanced spectral precision, faster data acquisition, and reduced system complexity.