Evaluation of Green Filters

I've been too busy to respond to the question about "Green Interference Filters (GIFs)". I use quotes because most of the them are not really Interference filters, the have very broad pass bands. I evaluated 2 low-cost "GIFs" bought for phase scopes, 4 dichroic style green filters[1] purchased with Nikon phase scopes, Kodak Wratten filters 58 & 102, a Schott (true interference) filter [<10 nm FHWM], and green filters from 4 different sets of red-green 3D glasses. I placed a tungsten light source in an Olympus BH-2 Pol scope and used a Microspectrophotometer (MSP) 300-1070 nm. I extracted the 400-700 nm data for comparison.

Some results were as I expected. For instance, the GIF filters are cheap filters. The Dichoic Style are a little better and the Schott glass was great. The Wratten 58 performed very well but the 102 was not so good. The scary result was my cheap 3D paper mounted glasses. They out performed everything but the Schott filter (>$350 when purchased; Edmunds has a similar one at about $400). Other green filters from "better" 3D glasses were OK from 400-600 but they has a second band in the 600-700 nm range. One notes the variability within the sets.

Type	**Wavelength Width at approx. Half-Max (nm)**
GIF-1	147
GIF-2	174
DCF-1	117
DCF-2	117
DCF-3	124
DCF-4	165
WF 58	94
WF 102	180
SIF 546	17
Cheap 3D Glasses	50

[1] The Nikon ones visibly reflect yellow while passing green. A number of other "GIFs" (like the ones I tested) do not reflect yellow; probably because the transmission in the yellow is not as great based on the MSP. See for instance Thor Labs FD1Y Green Dichroic filter.

So, the results beg the question - "what's it worth?". Having performed phase contrast with and without a filter, and having checked a resolution test slide with numerous PCM scopes both with and without a GIF or DCF filter, I'd say it improves contrast, visibility and resolution. However, this is for fine work (thin asbestos fibers), and I don't think it is necessary in many general cases. For use of an interference microscope or objective (B&L or Watson for instance), it is important. For a light-section microscope, it increases contrast and reduces fuzziness (variability). For evaluating retardation using a Senarmont compensator, it is even more important. Richards has noted an error of about 10% if one uses say 589 nm vs 546 nm; so this would be an upper end given the MSP data I generated. Richards also notes better precision with a better light source. I too have observed better precision with the Schott than the others [if a get a chance I'll do some stats on these findings]

Ref:erences

Richards, Measurement with Phase and Interference Microscopes, in ASTM STP 257, Symposium on Light Microscopy, 6-18, 1959.

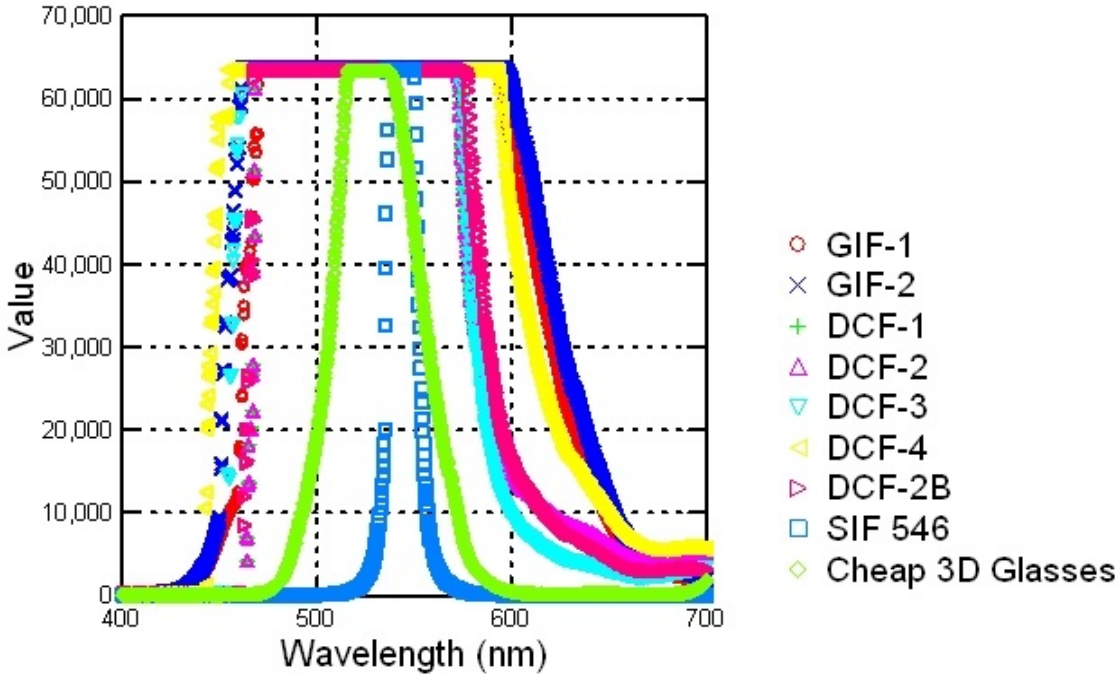

Figure 1. Modified Graph of Filter transmission Curves