

MicroChemicals

# Yellow Light for Lithography

- ▶ Requirements on Yellow Filters
- ▶ Possible Reasons for Insufficient Yellow Light
- ▶ Rapid Test for Suited Yellow Light
- ▶ Our Yellow Foils and Tubes

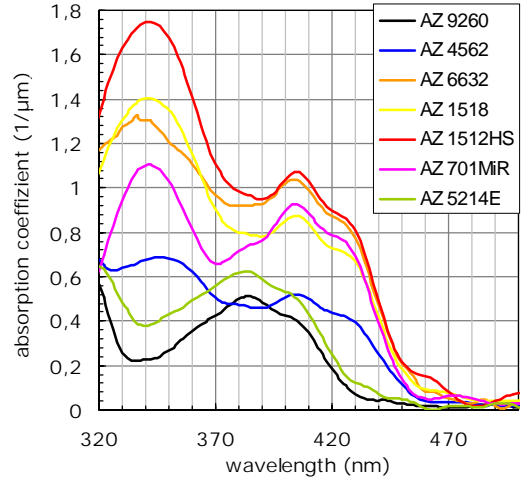
## Yellow Filter Requirements for Photo Resist Processing

### Spectral Sensitivity of Photo Resists

The spectral sensitivity of common g-, h-, and i-line broadband photo resists ranges from the near UV to the short wave VIS part of the spectrum in the range of 320 ... 470 nm.

The g-line absorption maximum at 435 nm wavelength is centred in the blue part of the spectrum and drops towards longer wavelengths without sharp absorption edge.

Only i-line resists at small resist film thicknesses show a negligible sensitivity beyond approx. 400 nm wavelength.



### Maximum Permissible Transmission at Short Wavelengths

White (Hg-) fluorescent tubes have a strong emission near 405 and 435 nm wavelength, which corresponds to the absorption maxima of common photo resists. Incident sunlight or daylight has also a high intensity in the spectral range absorbed by photo resists, which is not significantly blocked by common windows panes.

Without suited yellow filters, artificial light as well as daylight will expose substrates coated with photo resist within seconds or minutes with a dose of several mJ/cm<sup>2</sup> making reproducible litho-processes impossible.

Thus, a yellow filter with a transmission of 0.1 % below 500 nm wavelengths is not suited to allow the storage of coated substrates for several hours at exposed places in the clean room near windows or fluorescent tubes. Under these conditions, positive resists will show an increased dark erosion in the developer, which deteriorates the desired resolution and resist profile. Negative resists may form a crosslinked surface which can be not or only time-delayed penetrated by the developer.

Therefore, a yellow filter needs to block wavelengths below 500 nm almost completely in order to allow the storage of photo resist coated substrates over hours and days in the clean room.

### Long Wavelength Transmission Requirements

From 520 nm towards higher wavelengths, which corresponds to the maximum sensitivity of the human eye (555 nm) as well as an emission maximum of Hg fluorescent tubes (546 nm), the yellow filter should transmit as much light as possible. This allows to illuminate the clean room with reasonable energy input as well as to perform reproducible litho-processes.

## Possible Reasons for Insufficient Yellow Light

Many common yellow foils have a short wavelength transmission (< 500 nm) of approx. 0.1 % or higher, which is not low enough for reproducible litho-processes.

If unsuited polymers are used for the yellow foil, thermal stress from neighbored light sources can form small cracks in the foil over the years which transmit short wavelength light.

UV-radiation from aged and damaged Hg fluorescent tubes deteriorates unsuited dyes in the yellow foil which hereby, over the years, becomes more and more transparent for short wavelength light.

## Rapid Test for Sufficient Yellow Light Conditions

Do blue things appear bluish in your yellow room instead of gray or black as they should? This is a very considerable hint for unsuited yellow filters.

In any case, we recommend the following test at least once per year:

Coat a substrate with a positive photo resist and perform a standard softbake. Closely cover one half of the substrate with a black sheet or foil (or a piece of our suited yellow foil) and store the substrate at an exposed location (near an artificial light source, or a window) for one day. Then put the substrate into a suited developer for 5 - 10 minutes. If the half of the substrate which was not protected shows a (higher) erosion in the developer than the other half, it's time to exchange the yellow filters in your clean room with suited ones.

Please feel free to ask us for a free sample of your yellow foil for this test!

## Our Yellow Filter Foil and Fluorescent Tube Bushings

### Transmission Properties

Our yellow foil sufficiently blocks all radiation with wavelengths < 500 nm, and yields a high transparency for wavelengths > 540 nm. Thus this filter foil is perfectly suited for the processing for all common photo resists.

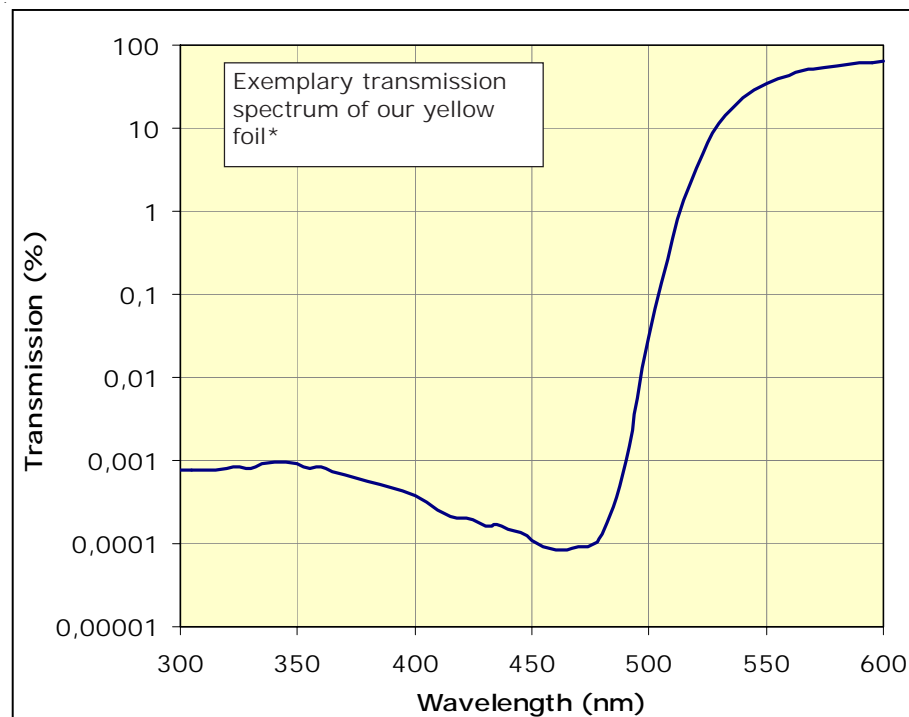
### Fields of Application

Our yellow foil can either be attached to windowpanes with UV stable double-faced adhesive tape (also supplied by us), or – ready-to-use assembled in polycarbonate bushing – fixed around white Hg fluorescent tubes.

### Sales Units and Dimensions of the Yellow Foil

Our yellow foil rolls have a width of approx. 108 cm, and lengths of 1 m, 10 m, 20 m or 50 m.

The foil is either attached between two windowpanes, or attached onto a window pane either in self-adhesive version, or with UV stable double-faced adhesive tape. Herefore, typically 1 - 2 UV tapes (á 55 m x 19 mm, available by us) are required for each 10 m yellow foil.



### Sales Units and Dimensions of the Bushings for Fluorescent Tubes

The dimension for the bushings depend on the diameter (T5 or T8) and lengths of the fluorescent tubes. We supply the following types:

**T5** (5/8" = 16 mm diameter): Length 55 cm, 85 cm, 115 cm and 145 cm

**T8** (8/8" = 26 mm diameter): Length 120 cm and 150 cm

Other lengths on request!

Please note that the bushings are NOT suited for HO (High Output) tubes due to the high heat development.

### Interested? Please contact us!

MicroChemicals GmbH, Nicolaus-Otto-Str. 39, 89079 Ulm, Germany  
Fon: +49 (0)731 977 343 0 Fax: +49 (0)731 977 343 29  
E-mail: [info@microchemicals.eu](mailto:info@microchemicals.eu) Internet: [www.microchemicals.eu](http://www.microchemicals.eu)

\* This transmission spectrum is not to be seen as specification, but as exemplaric measurement of a certain lot of our yellow foil.

Managing directors: Dr.-Ing. Titus J. Rinke, Dr.-Ing. Christian Koch  
Place of business: Ulm, HRB 4271 VAT-ID: DE813168639