

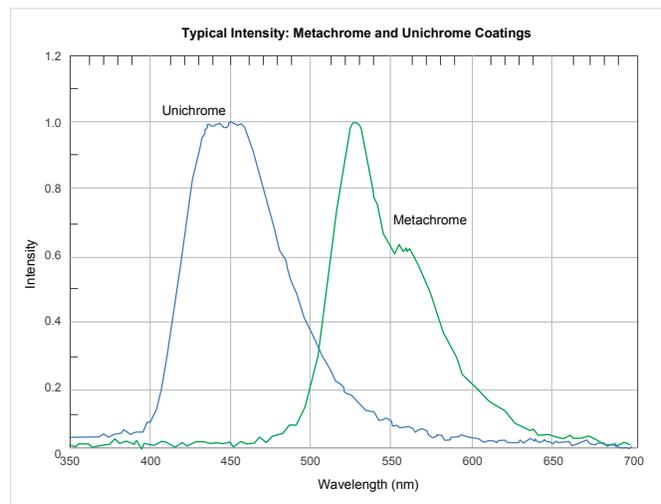
Metachrome® and Unichrome

Proprietary Coatings Extend Detection Capabilities of Silicon-Based Photonic Sensors into the Ultraviolet

Acton Optics & Coatings' proprietary Metachrome and Unichrome offer a cost-effective means of extending the detection capabilities of CCDs, CIDs, and CMOS sensors into the ultraviolet portion of the spectrum. Each coating can be deposited on practically any bare chip or packaged device, provided our technicians can access the sensor. Scientific and industrial uses include optical emission spectroscopy, inductively coupled plasma spectroscopy, and laser-induced breakdown spectroscopy.

Applying a thin layer of either of these composite phosphor coatings to the surface of a front- or back-illuminated sensor effects a dramatic increase in device sensitivity down to 120 nm. Peak photonic emission of Metachrome occurs in the green-visible region; Unichrome's peak emission is in the blue-visible range. See Figure 1.

Figure 1.



A material that absorbs higher-energy photons and re-emits them as lower-energy photons (e.g., absorbs ultraviolet light and re-emits it as visible light) is said to function as a “down” converter. The excellent conversion efficiency of Metachrome and Unichrome — combined with the high quantum efficiency of silicon-based sensors at the coatings' emission wavelengths — enables each proprietary coating to function as an ideal down converter when incident light wavelengths are shorter than 450 nm.

It should also be noted that when incoming light wavelengths are longer than 460 nm, the thin layer of Metachrome or Unichrome present on the sensor surface becomes transparent and thus has no detrimental effect on the quantum efficiency of the detector in the visible and near-infrared portions of the spectrum.

To investigate Metachrome's capabilities as a down converter in the far and vacuum ultraviolet, Prof. Dr. Tondello (University of Padua / University of Florence) measured the coating's response using a normal-incidence vacuum monochromator. The resultant data confirms that Metachrome is a highly effective scintillator for silicon-based sensors owing to its good quantum efficiency at wavelengths as short as 58 nm (see Figure 2).

Figure 2.



Utilization of either Metachrome or Unichrome with a front- or back-illuminated detection device also renders a much cleaner signal response. Due to its anti-etaloning effect, Metachrome typically yields a signal that is 7.5x smoother than that of an uncoated back-illuminated sensor (see Figure 3). In like manner, Unichrome typically yields a signal that is 1.5x smoother (see Figure 4).

Figure 3.

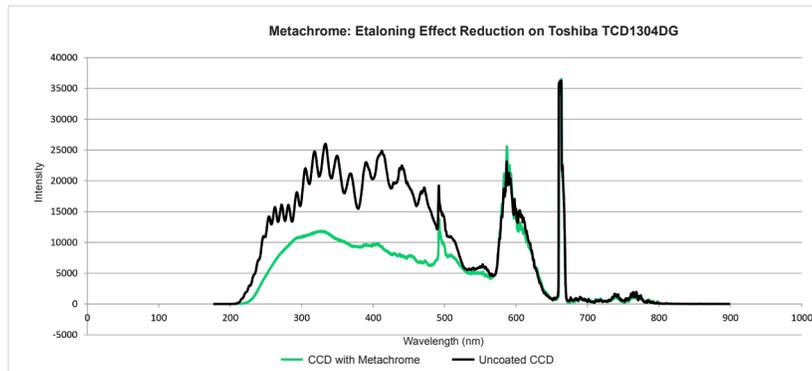
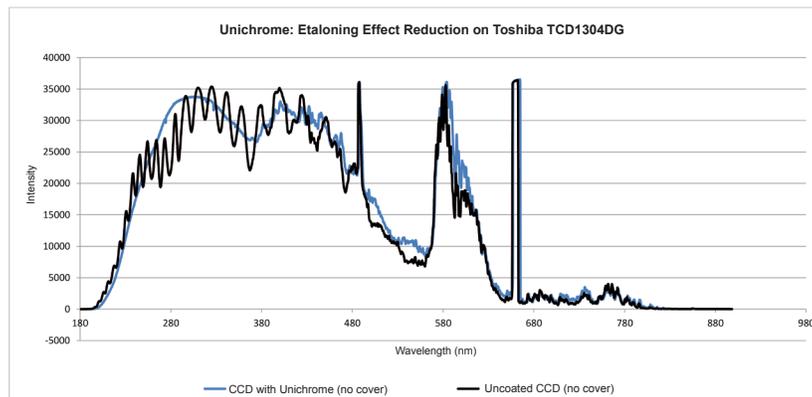


Figure 4.



Neither of these two proprietary coatings requires maintenance or degrades over time. Furthermore, extensive in-house tests of Metachrome and Unichrome have revealed no significant effect on spatial resolution, no evidence of cracking or delamination at temperatures as cold as -120°C , and no reduction in the coating's quantum efficiency with prolonged exposure to intense ultraviolet light.

There are thousands of parts that have been coated with Metachrome or Unichrome in the field today. Please contact your authorized Acton Optics & Coatings representative for more information.