

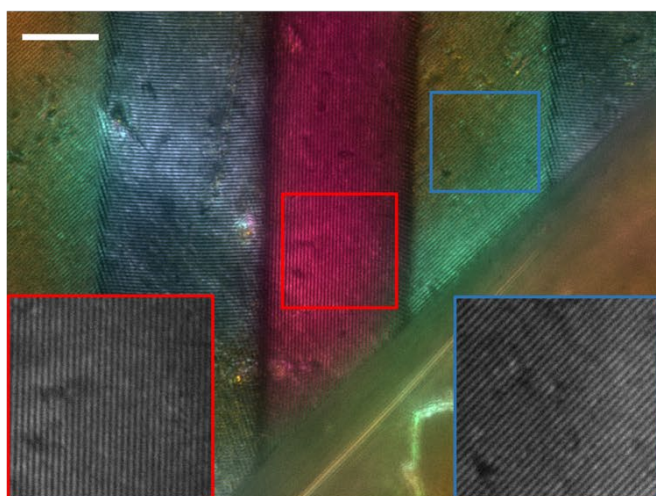
Security Printing

Security printing is a billion-dollar industry, often dependent on microcrystalline materials and micro-printed surfaces using diverse materials, reflective surfaces, and fine security features like microtext, optically variable devices (OVD), and holograms. These elements often exhibit varied optical properties—such as reflectivity, fluorescence, or transparency—that can complicate uniform imaging under standard lighting conditions. Variations in texture, wear, and lighting conditions further complicate high-resolution, non-destructive analysis. HaloMicroscopy overcomes these hurdles by delivering high contrast, widefield imaging of fine surface details, even on complex or reflective materials without damage or special handling.

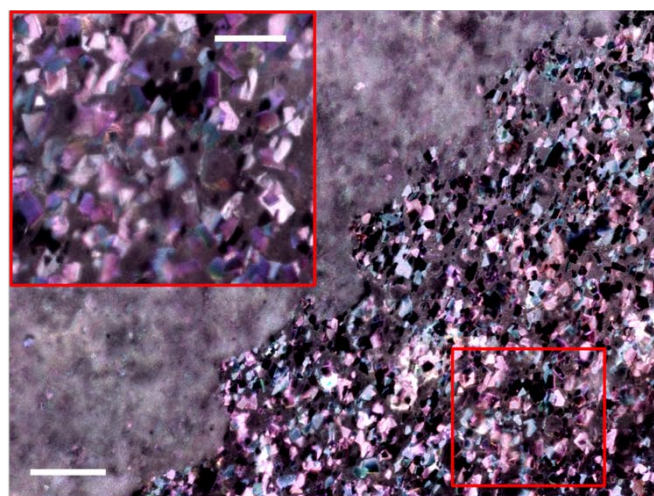
Complex Structures Embedded in Polymer Films

Banknotes, often polymer or fibre films with complex internal structures create barriers in seeing the internal detail in these sometimes opaque films. These internal structures are inaccessible using high-resolution surface measurement methods such as scanning electron microscopy and they often have specific patterns or orientations with detail that is difficult to detect with standard optical microscopy.

HaloMicroscopy was used to reveal the fine structure and orientation of diffraction gratings and 2D flakes embedded in a polymer and paper banknotes, and other security features.



A HaloImage of diffraction gratings in an anti-counterfeiting feature in a circulated bank note. The red and blue boxes correspond to insets showing the diffraction grating detail using a single frame in the image sequence where the light source is perpendicular to the diffraction pattern direction. (Scale bar: 20 μm)



A HaloImage showing the boundary of a region with 2-D reflective flakes creating a complex reflection pattern. While a 2D image, the differing 3D orientation of the flakes is captured in the colour variation linked to the location of the light source with respect to the flakes in the sample. (Scale bar: 80 μm , inset: 40 μm)

HaloMicroscopy reveals the fine detail and orientation in complex structures within transparent or opaque polymers. It works quickly and with little sample prep, making it ideal for imaging security features anti-counterfeiting coatings and OVDs in banknotes, security labels and packaging.