Hyperspectral Photoluminescence and Nanoparticle Measurements

CytoViva® Illuminating the Future

Hyperspectral microscopy is unique in its ability to measure the spectral response from very diverse sample elements within a single image. Examples would include materials producing photoluminescence emission and scatter from metallic nanoparticles. Significant research is being conducted at the nanoscale to incorporate these types of highly diverse materials into a single complex sample. Hyperspectral microscopy is proving invaluable to help characterize these sample elements and demonstrate their efficacy in both materials science and biotechnology applications.

Hyperspectral microscopy captures the optical spectral response in every pixel of an image. These pixels can be as small as 100nm spatially. Spectral resolution in each pixel can be as high as 2nm across the VNIR range from 400nm - 1,000nm. However, a key element for obtaining high quality hyperspectral images at the nanoscale is first creating high signal-to-noise microscopy based optical images.

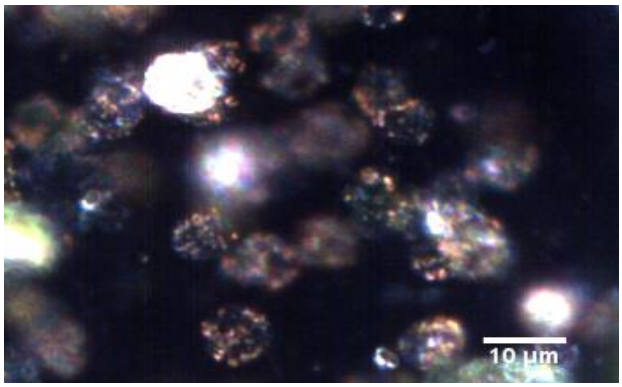

Figure 1: Enhanced Darkfield Hyperspectral Image of Phosphor Dye and Gold Nanoparticles in Hydrogel Matrix.

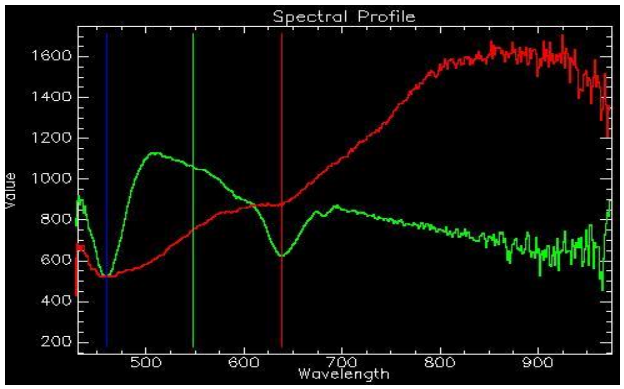

Figure 2: Representative Spectra of Phosphor Dye (green) and Gold Nanoparticles (red).

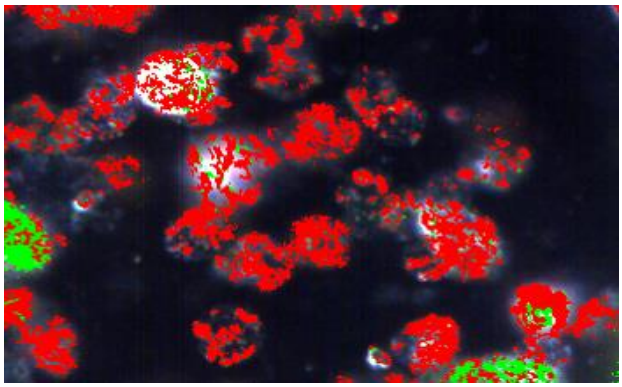

Figure 3: Spectral Mapping of Phosphor Dye (green) and Gold Nanoparticles (red) in Hydrogel Matrix.

Classification	# of Pixels	Percentage
Unmapped	143524	82.816%
Phosphor (green)	6943	4.006%
AuNP (red)	22837	13.177%

Figure 4: Class Distribution of Phosphor Dye (green) and Gold Nanoparticles (red) in Hydrogel Matrix.

CytoViva, with its patented enhanced darkfield optics, creates high signal-to-noise images of nanoscale sample elements, enabling very high quality hyperspectral images. These high signal-to-noise optics can enable the recording of photoluminescence emission and nanoparticle scatter from a single complex sample. See the example above which demonstrates the ability of the CytoViva Enhanced Darkfield Hyperspectral Microscope to enable observation, spectral characterization, and mapping of photoluminescence emission from phosphor dye

as well as the scatter from gold nanoparticles (AuNPs). This image was captured using standard halogen broadband illumination.

As seen in figure 1 above, the phosphor dye and gold nanoparticles are integrated into microcapsules in a hydrogel matrix. In figure 2, example spectra of the phosphor dye emission with a peak wavelength at 500nm is observed along with spectra from the gold nanoparticles with a peak wavelength at almost 800nm. Figure 3 represents spectral mapping in green of all pixels containing the phosphor dye emission spectra, while the gold nanoparticles are mapped as red. Finally, figure 4 demonstrates the class distribution denoting the percentage of image pixels mapping for both the phosphor dye emission and gold nanoparticle scatter in the sample.

Please contact us at info@cytoviva.com to learn more about CytoViva's Enhanced Darkfield Hyperspectral Microscope system and its ability to enable optical observation and hyperspectral characterization of a wide range of nanoscale sample elements from photoluminescence emission to nanoparticle scatter. We will be pleased to discuss test imaging of your samples or an onsite demonstration if appropriate.