CytoViva Laser Upconversion Hyperspectral Microscope

CytoViva has a hyperspectral microscopy solution which provides a nano-scale imaging format for studying photon upconversion. Promising applications of upconversion include high-capacity optical data storage and bio-imaging.

When certain rare earth ions are illuminated with IR light, visible light is emitted from processes of sequential two-photon absorption and energy transfer between excited rare earth ions. Bulk crystals and nanoparticles which have been doped with thulium and erbium give blue and green emissions respectively. Highly efficient upconversions are produced when the ions are combined with heavy-metal fluoride fibers (ZBLAN fiber). Dispersions of these nanocomposite materials and their upconversion properties can be studied using the CytoViva visible hyperspectral microscope with an IR laser package.

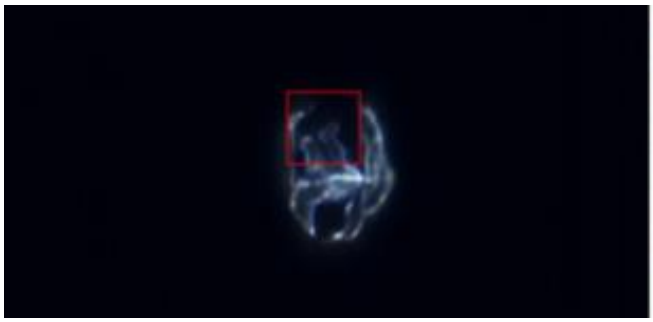

Figure 1: Sample imaged in white light with a cooled color camera

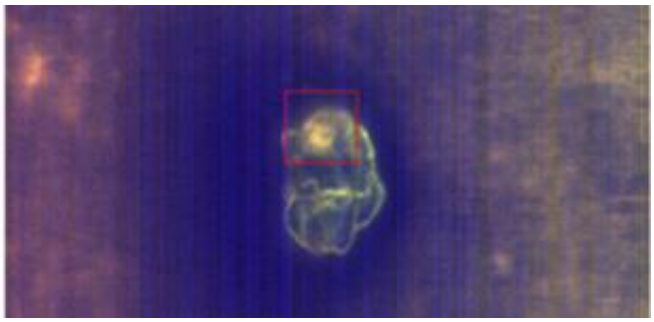

Figure 2: Hyperspectral upconversion image with laser excitation

Figure 1 and Figure 2 illustrate a comparison of visible light and upconversion images of crystalline NaYF4:Er imaged with CytoViva. The sample was illuminated with white light and laser excitation (975 nm) using a CytoViva enhanced dark-field illuminator. Emissions at 540 nm and 660 nm are rendered in color. Imaging shows the depletion of dispersed material around the crystal and the absence of correlation between bright regions in the color and upconversion image.

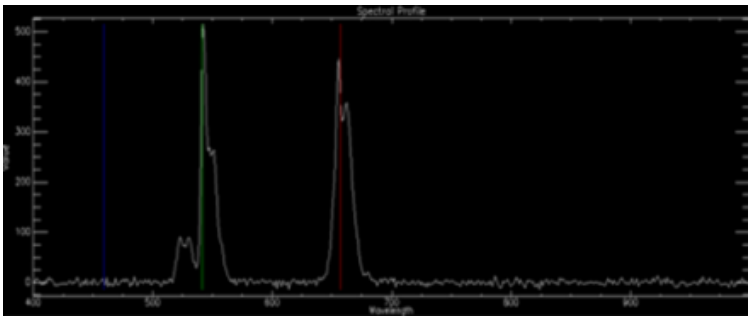

Figure 3: Upconversion peaks from the hyperspectral image

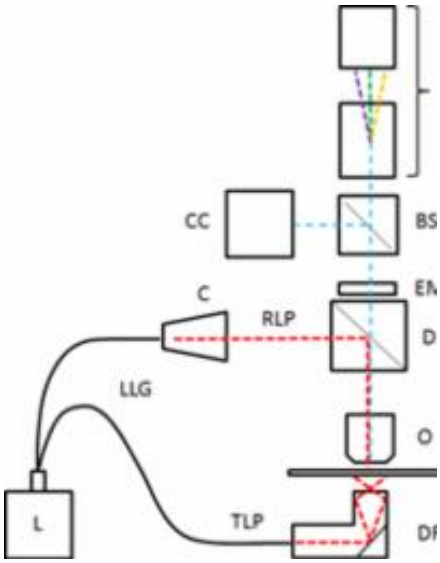

Figure 4: Component Diagram

Figure 3 shows the upconversion peaks from the hyperspectral image. The blue regime shows a cluster of emissions with up to four peaks. Green emission exhibits two closely spaced peaks.

Figure 4 is a component diagram of the CytoViva upconversion system. Symbols: BS=beam splitter, C=laser collimator, CC=color camera, DF=CytoViva dark-field illuminator, DM=dichroic mirror (laser block), EM=emission filter (400 - 700 nm), HSI=hyperspectral detector, L=laser diode (975 nm, 1W max), LLG=liquid light guides, O=IR objective, RLP=reflected light path, S=sample slide, TLP=transmitted light path. The laser diode is temperature-controlled. Camera (14 bit): interline camera or optional EMCCD camera.

For additional information, please contact CytoViva at info@cytoviva.com.