Mixed Quantum Dots for HD Displays (#7177)

Sid Malak and Vladimir Tsukruk from the School of Materials Science and Engineering at Georgia Tech have developed an effective technique for fabricating large-area multicolored emissive patterns in mixed quantum dot-polymer films which requires only a single deposition step. This approach uses a mixture of differently colored QDs and a new photopatterning technique, which is in sharp contrast to current photo-patterning approaches that utilize only a single QD component for monochrome patterns.

The method is appropriate for displays based on a patterned array of color filters that form the basis for the color filter subpixels. In this new technique, the color of each subpixel is created using specific photopatterning exposure conditions, with each exposure step being compatible with fast parallel processing techniques. The result is a patterned array of red, green, and blue (or yellow) color filters for corresponding subpixels. The ability to pattern the different colored subpixels results from the difference in absorption between the different color QDs. This size-dependent absorption is a very common feature of QDs and therefore allows this technique to be compatible with the majority of QD compositions currently in use.

QDs can be spatially patterned and easily tuned during synthesis, providing pure emission peaks over visible optical spectrum. The technology opens a simple route for fabricating large arrays of color filters with substantial advantages over the existing nanoscale and micro scale patterning techniques, such as optical and electron beam lithography, inkjet printing, multiple physical deposition steps, etc.

Benefits/Advantages

- One step fabrication of large-area multicolored emissive photo-patterns in mixed quantum dot-polymer films
- Potential for cheaper fabrication of color subpixels over a variety of controllable sizes, allowing for improved pixel density and image quality, while reducing number of physical deposition steps
- Can be activated by a simple UV light source
- Photo-patterns can be stored over a period of time and then “recharged” using simple light exposure to partially recover the intensity and contrast

Potential Commercial Applications

This has direct application in the fabrication of high-resolution color displays. In addition, because the patterning strategies open up new pathways for facile, one-step parallel fabrication of anti-counterfeiting emitting labels and light sensors, for example.

Background/Context for This Invention

Modern high-resolution/high-definition (HD) color displays demand small pixels that emit red, green, and blue wavelengths. A quantum dot (QD) display refers to the use of quantum dots (semiconductor nano-structures) in display technology, mostly to convert the backlight colors of LCD panels.

Sid Malak

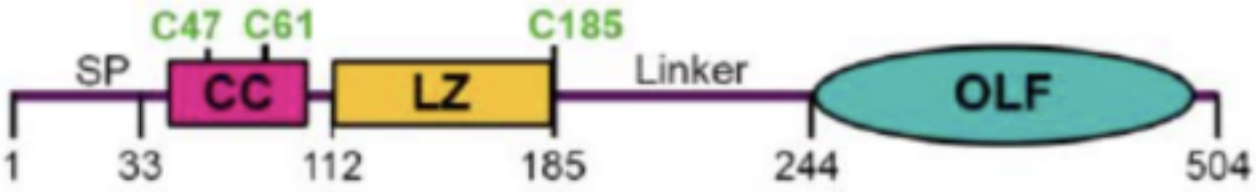
Dr. Vladimir Tsukruk
Regents' Professor - Georgia Tech School of Materials Science and Engineering

More Information

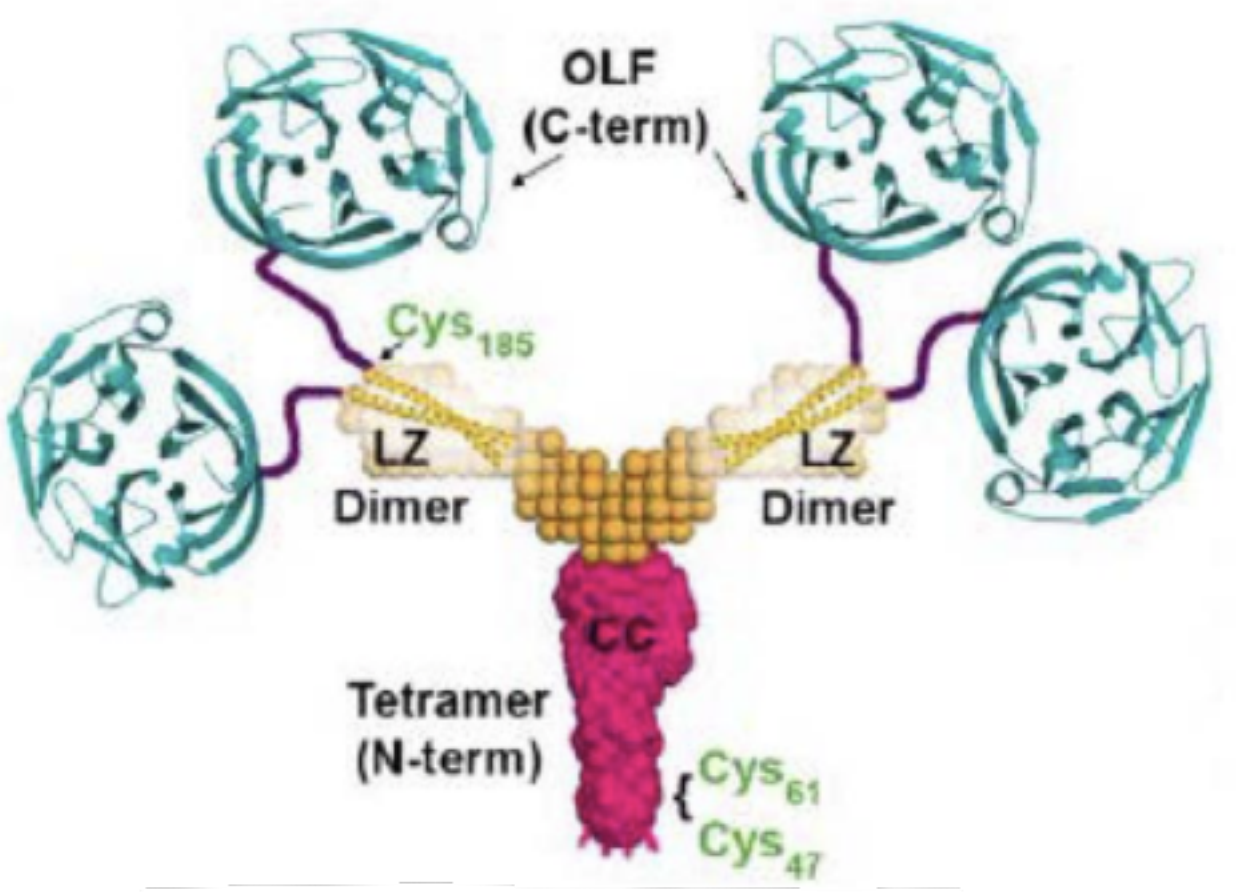
Publications

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/mixed-quantum-dots-hd-displays

Images:



The gene structure depicting the domains of myocilin, including signal peptide, location of key cysteine residues, and its coiled-coil, leucine zipper, and olfactomedin domains.



The myocilin quaternary structure based on solution X-ray scattering, X-ray crystallography, and chemical cross-linking experiments.