Stress tunes polymer laser output

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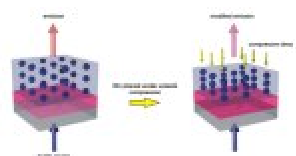
Displays and networks could benefit from a low-cost, thin-film tunable organic laser developed in the US.

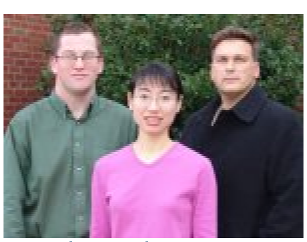
Researchers in the US have devised an affordable, thin film polymer laser for display and communication applications that can be tuned by simply applying a mechanical stress. (*Advanced Materials* **18** 300)

According to the Clemson University group, the device is easy to fabricate and features an organic gain medium sandwiched between a broadband mirror and a colloidal layer, which together form a resonator structure.



Schematic view

Straining the colloidal film changes the spacing between its constituent 150 nm diameter polystyrene particles and modifies the laser's rejection wavelength - a property that can be harnessed to tune the device's emission. To demonstrate the effect, the scientists compressed their thin film laser by 5% and observed a shift in output from 632 to 600 nm. Here, the polymer laser was optically pumped with a pulsed nitrogen source.



Polymer laser team

What's more, the team believes that its thin film laser is strong enough to be modulated at kHz frequencies. "Coupling the system to a low-cost pump source, such as a microchip laser, could open up commercial opportunities," Justin Lawrence of Clemson University's Center for

Optical Materials Science and Engineering Technologies told Optics.org. "However, the design is still in its early stages and will require some industrial input."

In their latest design, the researchers were able to avoid using a complex lithography step during manufacturing. In fact, the colloidal film is simply laminated onto the laser's one micron thick Rhodamine-B dye-enriched polymer layer.

"The major barrier was developing a robust plastic film with tailored physical properties that still exhibited an opalescence," said Lawrence. "Our synthetic approach allows us to de-couple the ordering of colloidal particles, which dominates the optical properties, from the encapsulation process, which gives the film its mechanical strength."

Author

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