NANOHOUR

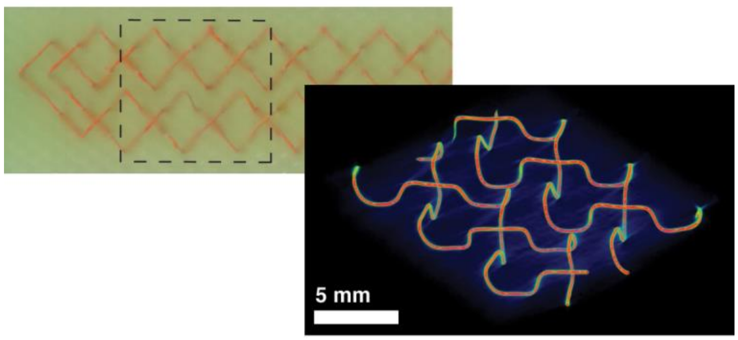
Wednesday, February 26, 2014 3:00 pm
Beckman Institute - Room 3269

Self-healing in Structural Composites via Bioinspired Microvascular Networks

Jason F. Patrick, Civil Engineering

Graduate Student with Professor Nancy Sottos and Scott White

Internal delamination damage in fiber-reinforced composites is difficult to detect and nearly impossible to repair by conventional methods. To date, this failure mechanism remains one of the most significant factors limiting reliability and leads to conservative design of composites for lightweight structures. In contrast to the remarkable progress in self-healing polymers, autonomous and recurrent repair of fiber-composites still presents significant challenges due to stringent processing and integration requirements. Here, we report multiple cycles of *in situ* delamination healing achieved through microvascular delivery of reactive fluids. Three-dimensional (3-D) vascular networks are introduced in the composite by vaporization of sacrificial fibers, with no degradation of inherent fracture properties. The vascular architecture is critical for *in situ* mixing, polymerization, and repeated healing of delamination damage. An interpenetrating vascular network results in full recovery (> 100%) of interlaminar fracture resistance, demonstrating the potential for improved safety and durability throughout the service life of high-performance composite structures.

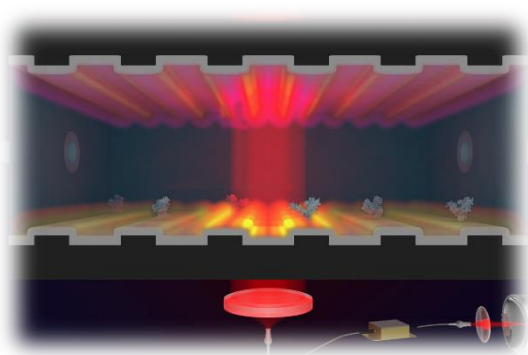


External Cavity Laser Label-Free Biosensor

Meng Zhang, Physics

Graduate Student with Professor Brian Cunningham

We demonstrate a single-mode, continuous-wave and electrically pumped plasmonic external cavity laser (ECL) that is tunable through altering the refractive index of liquid on a plasmonic crystal surface. The plasmonic crystal with extraordinary optical transmission is utilized as the wavelength selective element in the ECL cavity. Utilizing a semiconductor optical amplifier to provide broadband gain, lasing at the peak transmission wavelength of the plasmonic crystal is achieved. The plasmonic laser configuration maintains the high sensitivity of plasmonic sensors while achieves high spectral resolution through the spectrally sharp laser emission. The ability to measure refractive index changes with a detection limit of 1.79×10^{-6} RIU is demonstrated. The demonstrated approach represents a path towards label-free optical biosensing with greater performance than alternative methods.



Coffee and cookies will be served

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