Optical fibers functionalized with photonic crystal cavities

Stanford researchers have developed a simple and rapid epoxy-based method for transferring photonic crystal (PC) cavities to the tip of an optical fiber. The transfer process preserves robust cavity properties and the design architecture provides a practical mechanically stable platform for the integration of photonic crystal cavities with macroscale optics.

Applications

- Biological or chemical refractive index or near-field sensors
- Nanoparticle sensor for biomedicine
- Raman or fluorescence spectroscopy collection probe
- Near-field point source of illumination device
- Fiber-coupled nonlinear optics element
- Ultra-compact device sandwiched between two separate fibers
- Optically pumped photonic crystal lasers or LEDs coupled to fibers
- Single photon emitters such as quantum dots or nitrogen-vacancy centers coupled to fibers

Advantages

- **Rapid, simple, and inexpensive** without the complexities of other assembly techniques such as micromanipulation inside of a focused ion beam chamber
- **Avoids potential material contamination** from exposure to high energy electrons or ions
- **Compatible** with all material types
- **Flexible platform allows for integration of many diverse photonic functionalities**

Publications

- Gary Shambat, J. Provine, Kelley Rivoire, Tomas Sarmiento, James Harris, and Jelena Vuckovic. "Optical fiber tips functionalized with semiconductor photonic crystal cavities" *Applied Physics Letters*, 7 November 2011.
- Gary Shambat, Sri Rajasekhar Kothapalli, Aman Khurana, J Provine, Tomas Sarmiento, Kai Cheng, Zhen Cheng, James Harris, Heike Daldrup-Link, Sanjiv Sam Gambhir, and Jelena Vuckovic, "A photonic crystal cavity-optical fiber tip nanoparticle sensor for biomedical applications" *arXiv*, preprint submitted 3 April 2012.

Patents

- Published Application: 20130039616
- Issued: 9,588,254 (USA)

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