



## All-Optical Nano-Positioner

### Applications

- Nanopositioning of fiber tip based devices
- Nano/Chem/Biosensing
- Photonic circuits

### Problem & Solution

Whispering gallery modes (WGMs) derive their name from a famous acoustic phenomenon of guiding a wave by a curved boundary observed nearly a century ago. In optics, a WGM resonator uses this phenomenon by confining light within an interior region of a sphere via total internal reflection. Since the light can circulate around the sphere with a long life time due to little leakage, more versatility for optical signal processing can be realized. However, the commonplace bulky apparatus used in the development of WGM resonators has impeded their incorporation into a miniaturized system and tuning capabilities.

A means of achieving nanometer scale tunable coupling by taking advantage of thermal-mechanical effects arising from a unique microsphere stem fabrication, external laser heating and thermal expansion in a single mode optical fiber has been developed. With this system, the coupling gap between a micro resonator and a waveguide can be controlled optically with nanometer resolution thus stepping towards an integrated all opto-mechanical system.

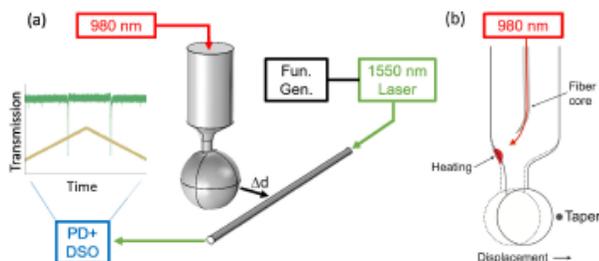
Our fiber based nano-positioner could be used to move not only a microsphere but any structure fabricated on the taper fiber tip such as plasmonic devices or AFM (Atomic Force Microscopy) tips.

### Keywords

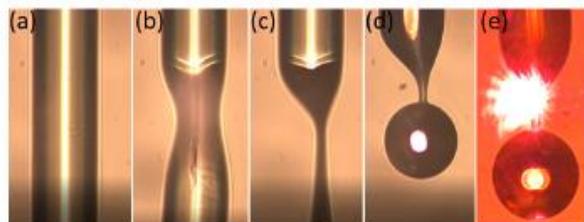
Opto-mechanical, Nano-positioning, All optical coupling, Microresonator, Waveguide.

### For more information

Business Development/Technology Licensing Section  
[bdtl@oist.jp](mailto:bdtl@oist.jp) or +81-(0)98-966-8937



A novel experimental set-up used to characterize the tunable thermal-mechanical coupling. The deformation of the fiber during fabrication redirects the incident laser light towards the stem. Once the stem region is exposed to laser light, the coupling distance between the microsphere and fiber can be manipulated.



Asymmetric stem fabrication method illustrating the initial state of the optical fiber and then the asymmetry resulting from side heating with a laser.

### Benefits

- All optical nano-positioning
- Precise tuning capability
- Higher sensitivity

### Patent Pending