High Q silica nanobeam cavity for simultaneous resonance of TE- and TM-like modes
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Abstract
We demonstrated the highest recorded Qs for a silica photonic crystal nanocavity of over 10⁴ for both TE and TM modes simultaneously. We also investigate the design of the cavity with TE and TM mode at same resonant wavelength. A Fano-like spectrum was numerically observed due to TE-TM mode coupling.

Background
PhC nanocavities
- High Q, extremely small V
- Integrated structure
Applications: Optical signal processing, quantum optics, sensing etc.

Challenges
- Small insertion loss
- Easy fabrication
- Polarization diversity

PhCs are not compatible with the multiplexing technique using polarization

Motivation
- Demonstrating high Q TE & TM modes in silica nanobeam cavity
- Investigating the feasibility of the coupling between TE & TM

Advantages of our cavity
- Transparent from visible to telecom wavelength range
- High Q of over 10⁴, which is as high as that of Si nanobeam cavity
- Can design a cavity with TE & TM mode at same wavelength

Basic properties of the silica nanobeam cavity
We measured the transmission spectrum of the silica nanobeam cavity

Nanobeam cavity with TE & TM modes at almost same wavelength
Our design has almost same TE & TM dispersion curves
We observed the coupling between TE & TM modes

Summary
- Demonstrated a silica nanobeam cavity with TE & TM mode simultaneously
- Achieved recorded highest Q of over 10⁴ for silica PhC nanocavity.
- Obtained Fano-like resonance numerically
- Fabricated a nanocavity with TE & TM mode at almost identical resonant wavelength

Future works
- Optimization of structure & measurement
- Investigate the feasibility of a cavity for circular polarization (in YZ plane).

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