

## Polaritons in a ZnO Tapered Microcavity

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Exciton-polariton is a quasi-particle formed by the coupling of photon and exciton in solid-state environment. One of the most important systems for realizing polariton in a strong coupling regime is semiconductor microcavity, in which the optical cavity modes can be tailored or tuned to resonant in energies with excitons. It has been predicted that the effective mass of exciton polariton with boson nature can be  $10^{-4}$  times of that of the free electron, thus the spontaneous bose coherence of polaritons are expected to occur at much higher temperature. From the point of view of application, the buildup of sponaneous coherent polariton state would trigger an inversionless lasing of so-called polariton laser. Unlike the conventional laser, the polariton laser has no threshold limited. Significant progresses on the bose coherent condensation and the polariton lasing have been made in 2-dimensional planar cavities [1-3]. One of the most exciting achievements is the realization of room temperature polariton lasing in a GaN planar microcavity [2]. Recently, polariton behavior in cavities with reduced dimensionality is attracting more attention [4, 5], since it is expected that the reduced dimensionality will greatly lift the wave vector conservation selection rules in polariton scattering, and it is an effective way to realize polariton quantum degeneracy under nonresonant pumping [4]. On the other hand, as one of the most commonly adopted cavity types for photon confinement, a whispering gallery (WG) resonator where photons are confined two-dimensionally has in deed its advantage for the light-matter interaction studies [5]. The overlap between exciton and cavity mode is greatly enhanced and can be close to unity due to the body of WG microcavity is itself an active medium for excitonic emission. However, despite the above advantages, polariton behavior in WG cavities is less understood, though it is of fundamental importance [5]. Moreover, tunability in both exciton-photon coupling strength and emission wavelength of a polariton laser out of a planar cavity remains difficult. In this talk, we demonstrate a tunable WG resonator for polaritons basing on a tapered ZnO nano-rod with a hexagonal cross-section. Comprehensive polariton behaviors, including the one-dimensional polariton dispersion, polariton wave-guide and polariton lasing are discussed. Our work demonstrates that ZnO WG microcavity is an excellent system for developing polariton-based devices operated at room temperature.

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