Nano-Tapered Fiber Based Micro Loop Resonator

Optical resonators have many potential applications in optical sensors, new kind of laser source and frequency comb [1]. In this paper, we fabricate micro/nano-fiber based on the fiber tapering technique. Using micro/nano fiber, we demonstrate the micro loop resonator (MLR), working at 1550 nm band whose resonance extinction ratio (RER) is 3dB and frequency spectral range (FSR) is 75GHz. The tapered fiber fabrication system is shown in Fig. 1(a) [2]. We use ceramic heater to heat the fiber. Two stepping drivers, controlled by a PC, are programed to pull the fiber with very low loss. We build MLR using tapered fibers of different waist diameters, varying from 5 μm, 2 μm, 1 μm, 800 nm, to 600 nm. The insertion loss is less than 0.1 dB. We use the tapered fiber to manufacture the micro-loop resonator which was illustrated in Fig. 1(b).

In the experiment, we utilize an broad band source to illuminate the micro-loop cavities. The spectrum of input light is plotted in Fig. 2(a) with red line and blue is for output with a micro-loop resonator, which made of a tapered fiber of 800 nm waist diameter. Fig. 2(b) shows the spectral response of Fig. 2(a). The higher loss occurs at long wavelength because bend induced loss is expected to be higher than at short wavelength. The FSR is 75GHz. The corresponding loop diameter around 0.8 mm, equals to 0.8π mm circumference. The resonance extinction ratio (RER) is about 3dB as. The corresponding Q-factor is about 5166.

The fabrication of tapered fiber and loop resonator can be further optimized to enhance extinction ratio and to reduce long wavelength bend loss.