Tapered Fiber Coupled Optical Micro-Resonator

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Introduction

Optical communication is one of the most dynamic sectors in today's communication areas due to huge bandwidth potential. A technology which used to increase the capacity in optical communications is multiplexing many wavelengths or channels into a single optical fiber on the transmitter side and extracting the necessary channels at the receiver side. This technology is known as wavelength division and multiplexing or WDM.

Aim

In this project, using a microresonator with a tapered fiber as the coupler to perform as an optical filter is being investigated.

Certain channels will be trapped inside the microresonator when the light passes the interaction region and those channels are filtered at the throughout port.

Fiber with circular and hexagonal shape is used as micro-pillar resonators in this project. This made the filter all-fiber-based.
Methodology

Tapered fibers are home-fabricated using fusion splicer in Optical Communication Lab. The fiber is tapered until the waist diameter is around 2-3 um to couple light into the microresonator.
Result

The data below shows the transmission spectrum of a MM tapered fiber (tapered fiber made from multimode fiber with 105um core diameter) coupled circular micro-pillar resonator.

\[ Q \approx 10^5 \]

The data between shows the transmission spectrum of a MM tapered fiber coupled hexagonal micro-pillar resonator.

Conclusion

- Circular micro-pillar resonator with MM tapered coupler has resonance mode with Q-factor in the order of \(10^5\) is demonstrated.
- Hexagonal micro-pillar resonator with MM tapered coupler has resonance mode with Q-factor in the order of \(10^4\).