Research on polarization characteristics of comb filter based on microfiber Sagnac ring

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Introduction

A comb filter based on microfiber Sagnac ring is proposed. The transmission spectrum and the polarization characteristics of the filter are analyzed theoretically and experimentally. The experimental results show that the variation of polarization angle will cause the transmission spectrum drift and the filter depth variation. The variation of wave peak intensity is approximately sinusoidal waveforms through rotating the polarization controller. The research will have a broad application prospect in DWDM systems.

Experiment

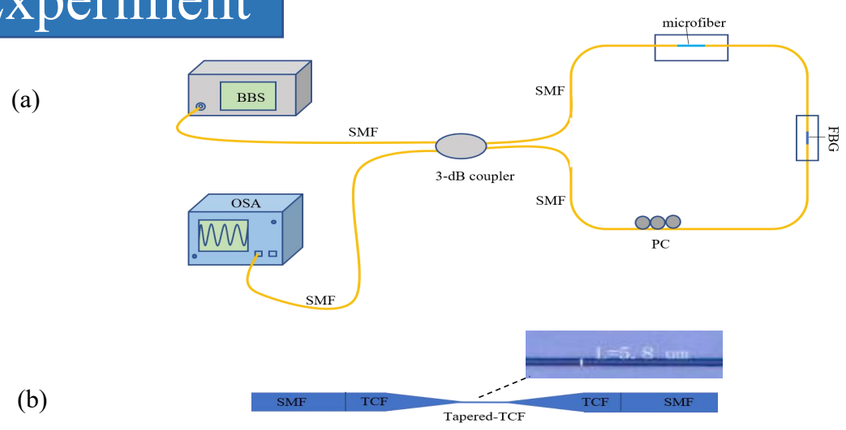

Figure 1. (a) Experimental device diagram (b) schematic diagram of microfiber structure.

This comb filter using a simple configuration: cascading a 3-dB optical coupler , a polarization controller, a microfiber and a FBG by the single-mode fibers. The fabrication process of microfiber structure is that the thin-core fiber is fused to two ordinary SMFs, and then thin-core fiber is stretched 15mm long by using fused taper technology. The lengths of Sagnac ring arms at both ends of FBG are equal. In the experiment, the polarization angle of PC is adjusted gradually from 0° to 180° in steps of 10°.

Results

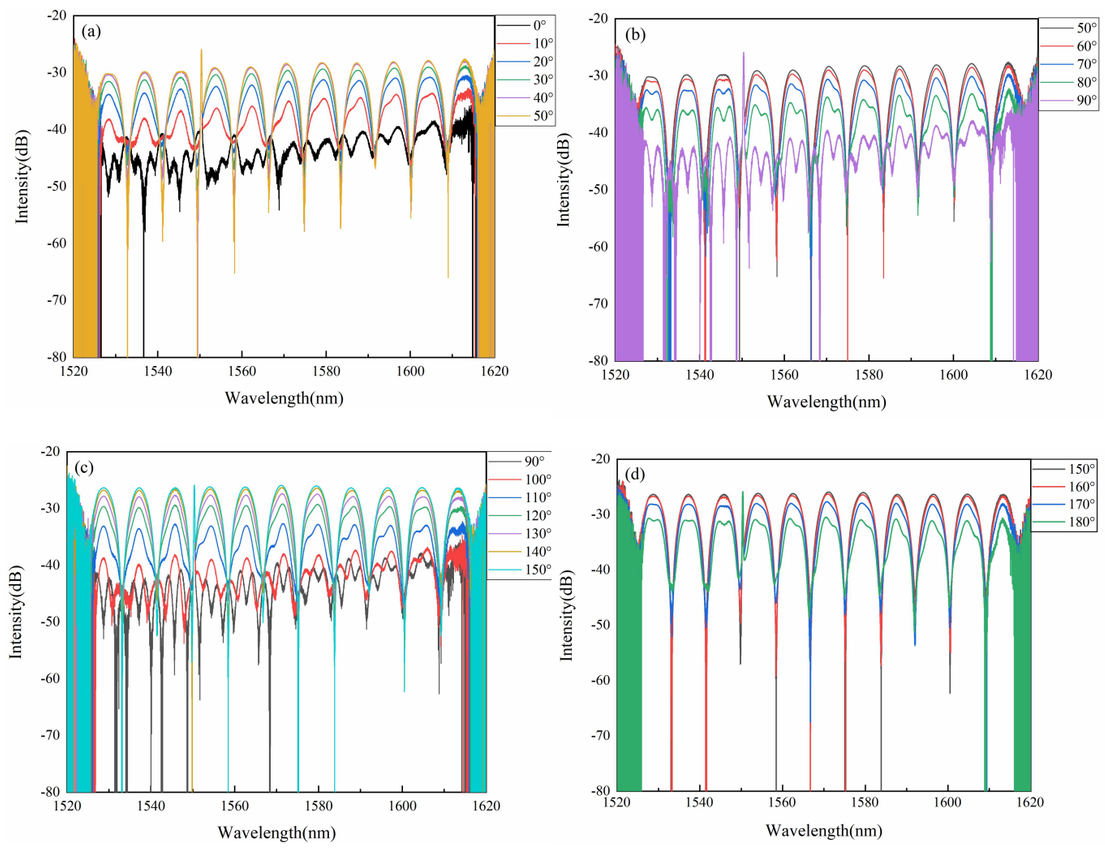

Figure 2. Spectrum diagram superposition under different polarization angles: (a) polarization angle 0° to 50° (b) polarization angle 50° to 90° (c) polarization angle 90° to 150° (d) polarization angle 150° to 180°.

There is an upward drift in the output spectrum when the angle of the polarizer changes from 0° to 50°. There is a downward drift of the output spectrum from 50° to 90°. There is a upward drift from 90° to 150° and a downward drift from 150° to 180°.

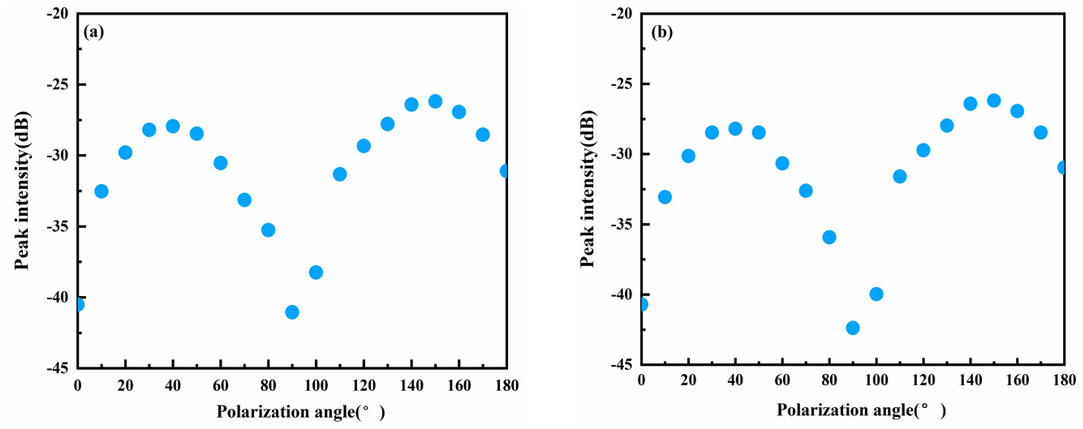

Figure 3. The variation of the wave peak intensity: (a) at 1537.492nm wavelength (b) at 1554.631nm wavelength.

The variation of the wave peak intensity of the filter with increasing the polarization angle of the PC is shown Figure 3. The results show that the variation of wave peak intensity is approximately sinusoidal waveforms.

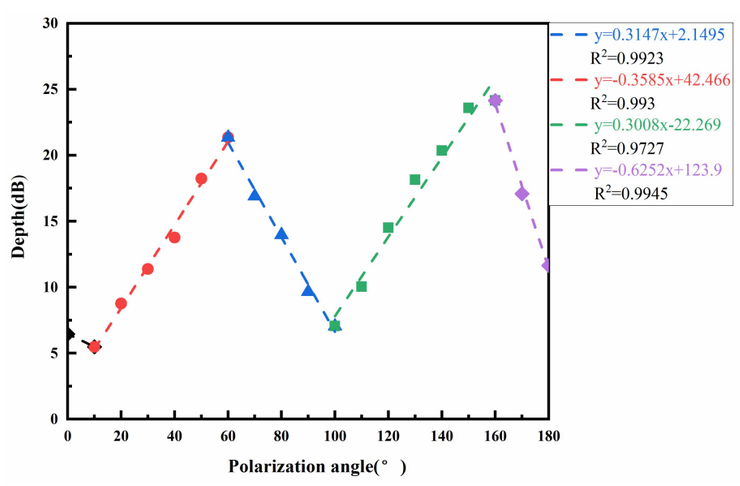

Figure 4. Relationship between filtering depth and polarization angle variation

The experimental results show that there is an obvious rule and a good linear relationship between the filtering depth and the polarization angle.

Conclusion

- The experimental results show that the polarization angle variation has an effect on the energy of the output spectrum of the filter. In a certain range of polarization angle changes, the output spectrum shape will drift up or down.
- The wave peak value variation of the transmission spectrum is approximately sinusoidal waveforms with the increase of the polarization angle.
- There are linear relationships between the filtering depth and the different polarization angle segments of PC, and the linearity is good.