Terpolymer-based polymer optical fiber for multimodal polarization-maintaining

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Introduction

Polarization-maintaining (PM) optical fiber is used in high-speed optical communication and fiber-optic interferometric sensing [1]. Existing PM optical fiber that is known for PANDA fibers intentionally form a large birefringence in the core radially [1]. By taking this structure, the PM function is obtained by suppressing the energy exchange between the orthogonal polarization components of the singlemode optical fiber. However, this principle is not effective in multimode fiber. In the past, it has been reported that a polymer optical fiber (POF) with its core fabricated using copolymer that can reduce intrinsic birefringence, namely, methyl methacrylate (MMA) and benzyl methacrylate (BzMA), exhibit a high extinction ratio compared to the other multimode optical fibers on the premise that no load is applied [2]. Therefore, in this study, POF of ternary core including 2,2,2-trifluoroethyl methacrylate (3FMA) in addition to the earlier material pair was fabricated. P (MMA / 3 FMA / BzMA = 52.0 / 42.0 / 6.0 (w / w / w) is known to be effective in eliminating two types of birefringence, namely, photoelastic birefringence and orientational birefringence [3]. As a result, it was proved that polarization maintaining effect is provided even when load is applied to this multimode fiber.

Results and Discussion

Fig.1 shows a polarized microscopic observation image obtained by adding a bending stress to the POFs. Fig.1 (a) is POF with binary copolymer core that is effective in eliminating only the orientational birefringence. Fig.1 (b) is the image of the POF with terpolymer as the core. The images show that the POF with terpolymer core does not exhibit birefringence even when the fiber was bent. Fig.2 shows the extinction ratios before and after adding loads to the reference and ternary POF, respectively. The waveform of the reference POF in Fig.2 (c) is shifted largely before and after the load. On the other hand, the ternary POF of Fig.2 (d) shows that there is less shift before and after the load compared with Fig.2 (c). As a result, high PM effect using terpolymer-core POF was demonstrated.

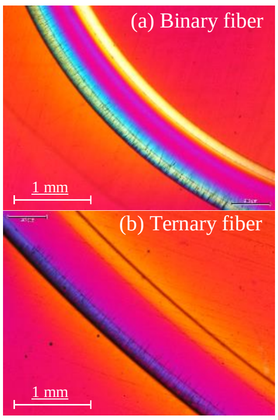

Fig.1 Polarized microscopic observation image obtained by adding a bending stress to the POFs. A region where no birefringence occurs is indicated by a pink color.

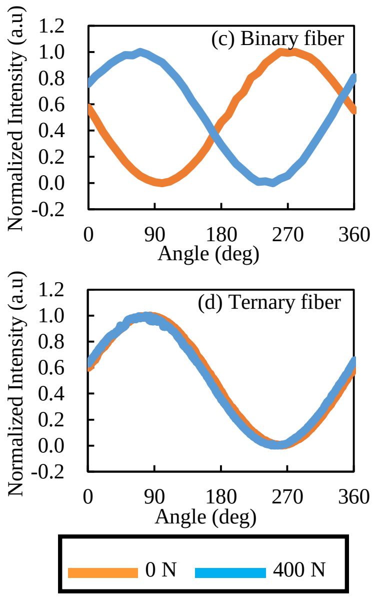

Fig.2 extinction ratios before and after adding loads to the POFs. The smaller the shift change is, the higher the PM effect can be expected.

References

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