

**SUMMARY OF Ph.D. DISSERTATION**

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| School<br>Integrated Design Engineering  | Student Identification Number | SURNAME, First name<br>FURUKAWA, Rei |
| <p>Title</p> <p><b>Polarization maintaining and phase retarding properties of a birefringence controlled plastic optical fiber</b></p>   |                               |                                      |
| <p>Abstract</p> <p>The proposed work is a partial assembly of the technologies of the birefringence-reduced copolymer and the plastic optical fiber (POF). POF with P(MMA/BzMA) (copolymer of methyl methacrylate and benzyl methacrylate) core was studied in terms of birefringence affection to the multimodal fiber optic waveguiding. Existing polarization-maintaining fibers (PMFs) could be fabricated only in singlemode (SMF) because of their designs. Therefore, phase optics in multimode fiber has not been dragging so much attention in the past because of its complexity in multiple wavefronts. In this dissertation, P(MMA/BzMA) was shown to be uniquely suited for making a MMF that got controlled birefringence regardless to the processing precision. This way, relatively smooth wavefronts could be obtained in addition to the original advantages of MMFs such as the large spotsizes and convenience in light couplings. A pressure sensor design was proposed using another unique function of the P(MMA/BzMA) POF, which is the phase retarding function. The proposed design had enabled to replace the interferometric design of typical SMF-based pressure sensor by using a simple polarimetry.</p> <p>Chapter 1 and 2 respectively explain the research motivation and conceptual theories that the work had been based on. Chapter 3 explains all the techniques used for measurements and sample preparations. Chapter 4 discusses the modal dependence of the polarization-maintaining property of the P(MMA/BzMA) POF. Chapter 5 discusses the phase retarding phenomenon induced by the P(MMA/BzMA) POF macrobending. Chapter 6 discusses about the pressure sensor design using phase retarding induced by vertical pressure applied to the P(MMA/BzMA) POF. Chapter 7 concludes the dissertation.</p> |                               |                                      |