THE SUMMARY OF Ph. D. DISSERTATION

Major		SURNAME, Firstname
Materials Science		KURIKI, Ken

Title

Design of Plastic Optical Fiber Lasers and Amplifiers with Organic Dyes and Lanthanide Chelates

Abstract

As fiber-optics links move closer to the consumer, people are searching for ways to cost-effectively optically wire the desktop and the home. Fiber optics will become more efficient as light waves replaces electrons for processing signals in access networks where the standard copper wiring has been used for over a century. Many believe the answer lie with Plastic Optical Fiber (POF), as it is potentially cheap and easy to install and connect. POFs have several advantages over traditional glass fibers. One big attraction is that, like the growing technology of polymer electronics, POF offers the prospect of cheap mass-production. POF is not only more flexible than glass fiber, but also with high bandwidth and low attenuation.

This work focuses on Graded-Index Plastic Optical Fiber (GI POF) doped with organic active dopants. Organic dyes and lanthanide chelates were successfully incorporated into GI POF. Plastics are compatible with organic active materials and amenable to high concentrations of those, which realize high outputs and gains in short lengths of fibers.

The organization of this thesis is as follows. Chapter 2 provides the

theoretical background necessary for understanding. Chapter 3 discusses the design, preparation and characterization of lanthanide chelates as an activator. Chapter 4 presents fabrication and characterization of a variety of doped plastic optical fibers. All the results from lanthanide chelates-doped plastic optical fibers are shown in Chapter 5. The issues concerning the possibility of lanthanide chelates-doped plastic optical fiber amplifiers are also presented in this chapter. Neodymium, praseodymium and erbium ions were successfully incorporated into the core of deuterated plastic-based optical fiber. The spectra of these fibers have several strong absorption bands in the visible and infrared regions. The fluorescence lifetime at 1060 nm of Nd-chelate doped plastic optical fiber with an uncooled photodiode was obtained. Chapter 6 deals with organic dye-doped GI POF lasers (GI POFL). This chapter not only deals with chemical, physical and spectroscopic properties of organic dyes in plastics, but also, presents the results of lasing performance against a lot of parameters. The best laser performance was achieved in a rhodamine 6G-doped GI POFL, fabricated by the Interfacial-Gel polymerization technique, with a slope efficiency of 43 % and a half-lifetime of 110,000 shots with a frequency-double Q-switched Nd:YAG laser at a 10 Hz repetition rate. Finally, Chapter 7 provides a brief summary of the thesis and suggests directions for the future research.