GRIN lens. Fundamental characteristics (e.g., spatial resolution and dynamic range) were discussed and OCT images of test sample and onion were shown. This compact OCT system may be utilized with imaging optics for endoscopic applications.

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CTuY6 **6:15 pm**

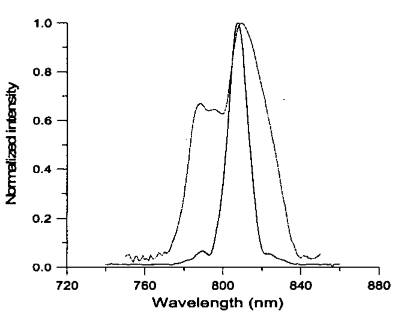
Polarization-Sensitive Optical Coherence Tomography Using Self-Phase Modulation in Fiber for Broadband Source Generation

I-Jen Hsu, Shin-Ming Lin, Chih-Wei Lu, Chih-Ren Deng, Jui-Che Tsai, Yean-Woei Kiang, C.C. Yang, Chih-Yu Wang,* Chii-Wann Lin,** *Department of Electrical Engineering, Graduate Institute of Electro-Optical Engineering, and Graduate Institute of Communication Engineering, National Taiwan University, 1, Roosevelt Road, Sec. 4, Taipei, Taiwan, R.O.C.; Email: ccy@cc.ee.ntu.edu.tw; *Department of Bioengineering, I-Shou University, Kaohsiung, Taiwan, R.O.C.; **Graduate Institute of Bioengineering, National Taiwan University, Taipei, Taiwan, R.O.C.*

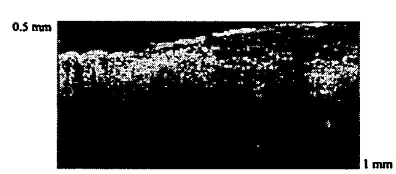
Optical coherence tomography (OCT) has been widely studied for high-resolution subsurface tissue scanning. Because the longitudinal resolution in OCT scanning is inversely proportional to the light source bandwidth, pursuing means for generating broadband light source, either coherent or incoherent, is crucial for OCT development. In this paper, we report the use of self-phase modulation in a single-mode fiber to generate broadband source for building a polarization OCT system.[1] Due to the Kerr effect in fiber, self-phase modulation of a short pulse can induce a nonlinear phase distribution, which is equivalent to the generation of chirp or spectrum broadening.[2]

In experiments, about 100 fsec pulses from a mode-locked Ti:sapphire laser were end-coupled into a single-mode fiber of about 5 m. When the coupled power was between 200 to 400 mW, the output spectral width ranged from 50 to 70 nm. Figure 1 shows the spectra of the fiber input and output when the power coupled into the fiber was 200 mW and the input central wavelength was 810 nm. The original 10 nm wide spectrum has been broadened to around 50 nm. This pulsed light source of broad spectrum was used for a typical free-space OCT system (Michelson interferometer) with polarization control. In the system, a constant-speed stage was used in the reference arm for phase modulation and depth scanning. A lens with 3 mm in focal length was used for focusing light beam onto samples. The beam size at the focal point was estimated to be around 5 μm, which corresponded to the resolution of the lateral scan. The high lateral resolution was chosen at the expense of a short depth of focus or depth range of scanning, which was estimated to be around 100 μm. The power incident upon samples was around 50 mW. In polarization tomography operation, circularly polarized signals were applied onto samples. A polarizer was then used before the photo-detector for polarization-gated scanning. The depth resolution was tested to be from 5 to 10 μm, depending on the input power to the fiber. The sensitivity was estimated to be higher than 100 dB.

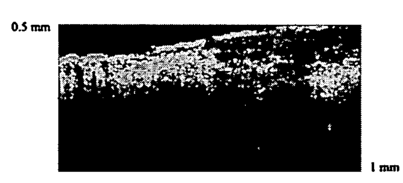
We have used this system to scan various tissue samples. Figures 2 and 3 show the results of polarization OCT scanning of chicken leg tissue. The lateral scan was along the direction of tissue filaments. Figures 2 and 3 correspond to the cases of the summation and difference of the two polarization components, respectively. The difference image can show clearer features of such skeletal tissue, compared with the summation image. The light source bandwidth for these scans was 50 nm, corresponding to a depth resolution of about 10 μm. The circular features on the right could probably originate from certain cavity structures. This OCT system was used for tissue burn study. The results will also be presented. It is expected that with suitable control of group-velocity dispersion in fiber through tapering, the bandwidth of the OCT light source can be further increased.



CTuY6 Fig. 1. Fiber input and output spectra when the power coupled into the fiber was 200 mW and the input central wavelength was 810 nm.



CTuY6 Fig. 2. OCT scanning image of chicken leg tissue with the summation of two polarization components.



CTuY6 Fig. 3. OCT scanning image of chicken leg tissue with the difference of two polarization components.

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CTuZ

4:45 pm–6:15 pm
Room 337/338

Materials for Nonlinear Frequency Conversion

Fredrik Laurell, *Royal Inst. of Tech., Sweden, Presider*

CTuZ1 **4:45 pm**

Influence of crystallinity on bulk laser damage threshold of $CsLiB_6O_{10}$ crystals

Masashi Yoshimura, Tomosumi Kamimura, Richi Ono, Yoke Khin Yap, Yusuke Mori, and Takatomo Sasaki, *Department of Electrical Engineering, Osaka University, 2-1 Yamada-oka, Suita, Osaka 565-0871, Japan; Email: yoshi@pwr.eng.osaka-u.ac.jp*

Tetsuo Kojima, Susumu Konno, Shuichi Fujikawa, and Koji Yasui, *Advanced Technology R & D Center, Mitsubishi Electric Corporation, 8-1-1 Tsukaguchi, Amagasaki, Hyogo 661-8661, Japan*

Mitsuhiro Tanaka and Yukikatsu Okada, *KogakuGiken Co., Ltd., 135 Nurumizu, Atsugi, Kanagawa 243, Japan*

Because of cost-performance and convenient operation, solid-state ultraviolet (UV) lasers with nonlinear optical (NLO) crystals are in high demand for various industrial and medical applications. $CsLiB_6O_{10}$(CLBO) is suitable for fourth- and fifth-harmonics generation of pulsed Nd:YAG lasers.[1,2] Generally, laser-induced damages and UV light absorption of NLO crystals limit the power scaling of UV lasers. Improvement of bulk quality can effectively reduce the absorption and enhance the laser damage threshold. Recently, we developed a stirring-solution technique to grow high-quality CLBO crystals.[3] In this paper, we discuss influence of the crystallinity on the bulk laser damage threshold. The high-quality CLBO have approximately 2.5-fold higher damage threshold then fused quartz and conventional CLBO. As preliminary results, we also found the newly developed CLBO has lower absorption and can generate high-power UV lights.