

## POLARIZATION SENSITIVE OCT FOR SCATTERING MATERIALS EXAMINATION

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Optical Coherence Tomography (OCT) is a unique technique of cross-sectional and three-dimensional visualization of inner structure of different type of materials. This method is based on low-coherence interferometry, and the OCT enables in situ investigation in non-contact and non-destructive way. With the aid of OCT one can analyze a structure of investigated materials with measurement resolution reached a few  $\mu\text{m}$ , high sensitivity and high dynamic range. Nowadays, this method is highly applied in medical treatment especially in dermatology and ophthalmology [1] and also in industry and science [2][3]. Recent researches on OCT expand its applications to materials characterization, multilayered structure investigation [4], art conservations [5] and many other fields beyond medical applications. Our research interests have been concentrated on polarization sensitive OCT (PS-OCT) for investigation of highly scattering objects. The polarization sensitive analysis, based on polarization diversity detection, expands the OCT measurements by selective investigation of anisotropic structure in an investigated material. Therefore, it is possible to determine birefringence principles of the device, as well as study the phenomenon causing materials anisotropy. An example of such examination might be birefringence determination of PLZT ceramics or strain field mapping in composites materials. Until now, we concentrated our studies on investigation of PLZT ceramics, polymer composites and painted anticorrosion protecting coatings. By the use of PS-OCT, the homogeneity of PLZT ceramics and polymer composites structure were examined. The study of polymer composites subsurface layer gives information about their rheological properties. For anticorrosion coatings, a corrosion progress and process of painted coatings delamination were monitored. Obtained results show the usefulness of PS-OCT system for surface and subsurface defects examination of wide range of highly scattering materials. Unique features of PS-OCT, like no-destructive and no-contact measurements, polarization sensitivity, high measurement resolution, make this system an interesting tool for inspection of multilayered scattering devices.

1. P. Targowski, M. Wojtkowski, A. Kowalczyk, T. Bajraszewski, M. Szkulmowski, I. Gorczyńska, "Complex spectral OCT in human eye imaging in vivo", *Optics Communications* **229** (1-6), 79-84 (2004).
2. D. Stifter, "Beyond biomedicine: a review of alternative applications and developments for optical applications and developments for optical coherence tomography", *Applied Physics B* **88** (3), 337-357 (2007).
3. M. Strąkowski, J. Pluciński, M. Jędrzejewska-Szczerska, R. Hyspser, M. Maciejewski, B. B. Kosmowski, "Polarization Sensitive Optical Coherence Tomography for Technical Materials Investigations", *Sensors and Actuators A* **142** (1), 104-110 (2008).
4. K. Wiesauer, M. Pircher, E. Götzinger, C. K. Hitzenberger, R. Oster, D. Stifter, "Investigation of glass-fibre reinforced polymers by polarization-sensitive, ultra-high resolution optical coherence

tomography: structures, defects and stress”, *Composites Science and Technology* **67** (15-16), 3051-3058 (2007).

5. D. C. Adler, J. Stenger, I. Gorczyńska, H. Lie, T. Hensick, R. Spronk, S. Wolohojian, N. Khandekar, J. Y. Jiang, S. Barry, A. E. Cable, R. Huber, and J. G. Fujimoto, “Comparison of three-dimensional optical coherence tomography and high resolution photography for art conservation studies”, *Optics Express* **15** (24), 15972-15986 (2007).