Novel photonics polymers for high-bandwidth and high-quality communication technologies

Professor Yasuhiro Koike, Keio University, Japan

Abstract: Based on the fundamental research for more than thirty years on the correlation between polymer structures and photonic phenomena, we have proposed novel photonics polymers, such as Graded-Index Plastic Optical Fiber (GI POF), Highly Scattered Optical Transmission (HSOT) polymer, and zero-birefringence polymer. Control of the refractive index distribution radially within the fiber core in the dimension of hundreds thousand nanometer led us to propose the world's fastest GI POF covering 40 Gbps data transmission. Utilizing the specified scattering phenomena by controlling the dimension of thousands nanometer heterogeneities in polymer, the HSOT polymer for much brighter display compared to conventional transparent backlight was proposed, which has been commercially used as PC backlights such as SONY VAIO etc. The birefringence seriously degrades color uniformity in display and is a persistent demerit of polymer materials, which is easily caused by nanometer-sized anisotropic structures of polymers when polymer is oriented. The idea of compensating this anisotropic structure in the dimension of nanometer led us to propose the zero-birefringence polymer. Our proposed novel LCD has layers of zero-birefringence films that are sandwiched between HSOT backlight and diffuser. As the light from HSOT backlight is collimated with no tilt angle, the retardation film that is needed in conventional LCD to compensate birefringence is no longer needed. The collimated light through LCD cell is diffused keeping optimized viewing angle by HSOT diffuser placed at the front of the LCD. It is noteworthy that the color shift of our proposed LCD is much smaller than any other LCD TV and monitors, although the LCD structure is much simpler than conventional ones. By connecting the ultra-high speed GI POF possessing super-high bit-rates to high quality display, it realizes an overwhelmingly sensational real time face-to-face communication. It can be ideally installed in every home, building, and hospitals. The quality of video image can be improved to the level of medical applications. The key to this development is the photonics polymer, which will totally change today's means of communications.

Biography: Yasuhiro Koike received his B.S. at Keio University in 1977, M.S., in 1979 and

Ph.D. in 1982 in applied chemistry at the Graduate School of Engineering of Keio University. He is Professor at Keio University since 1997 and specializes in "photonics polymer" such as graded-index polymer optical fiber (GIPOF), highly scattered optical transmission (HSOT) polymer, zero birefringence polymer, etc. He has been pursuing a government project on Face-to-Face Communication system in the FIRST Program of the Cabinet Office of Japan since 2010. He is a recipient of International Engineering and Technology Award of the Society of Plastics Engineers, the Fujiwara Award, and Medal with Purple Ribbon in Palace, etc.