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Observation of coherent perfect absorption in transparent thin films using a white light source

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The concept of coherent perfect absorption (CPA), in which 100% absorption can be achieved in ideal casesdue to the interfernce of (generally multiple) coherent light beas in the Fabry-Pero resonator was reported previously. Preceding studies were conducted to examine a simple method for single-channel CPA in transparent materials. In the present study the process was experimentally realized with a single dielectric layer sandwiched between semi-infinite dielectric layers and using total internal reflection by grazing incidence. In a 1.48-μm thick polyvinylpyrrolidone (PVP) film dip-coated on a MgF2 substrate, collimated white light from a Xe lamp was incident from the side of the substrate, multiply reflected in the PVP layer, and was extracted from the opposite side. A reduction in visible reflectance due to absorption by a single channel CPA of nearly 90% was observed over the wavelength range of 219-803 nm. using an ITO film on a glass substrate and an oil film on water. By taking advantage of the fact that CPA can achieve 100% absorption when there is a small amount of absorption even in almost transparent materials, the transmission spectra of a faint absorption of the film was measured with white lamp light illumination incident from one side of the substrate on the thin film, and then totally reflected at the interface between the film and air. Compared to the single channel CPA (SCCPA) scheme previously reported so far, this system can be easily prepared and is expected to have a wide range of applications including use as a material for basic research because of its configuration feasible without any need for expensive equipment or materials.

Biography

Takayoashi Kobayashi has completed his PhD from U. of Tokyo in 1972. He was a Resercher of Riken from 1972 till 1980. He stayed in Bell Laboratory during 1978-80. He became a professor in the Faculty of Science of the University of Tokyo from 1980 till 2006 and became a Professor Emeritus in 2006. He was awarded The Fellow of Society of America, The Chemical Society of Japan Award, Fellow of the Chemical Society of Japan, Senior Member of the Optical Society of America (at present Optica), Fellow of the Laser Society of Japan. He published more than 620 original papers in refereed journals.