

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

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A basic research was conducted to examine a simple method for single-channel coherent perfect absorption (CPA) in transparent materials. It 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 MgF_2 substrate (Fig1.(a)), 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 (Fig1. (b)). This result was closely reproduced by the calculation (Fig1. (c)). This is a simple and inexpensive CPA method, and various applications are expected by changing the substrate / polymer material and dispersing molecules in the polymer film. In this presentation, we will also show the latest results in CPA observation using an ITO film on a glass substrate and an oil film on water.

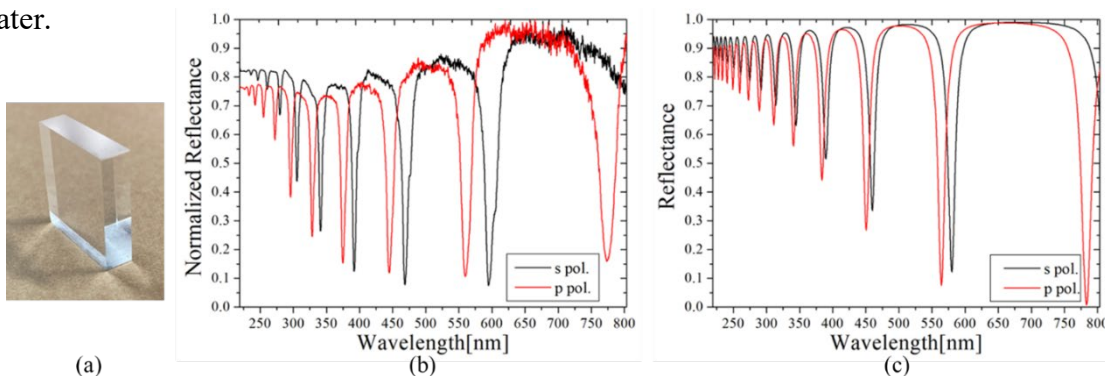


Fig1. (a) Dip-coated PVP film on a MgF_2 block of $20 \times 20 \times 5 \text{ mm}^3$ (b) Observed CPA spectra of PVP film on MgF_2 (c) Simulation of CPA (Incident angle 88.5 degrees, film thickness $\sim 1.48 \mu\text{m}$)