Development of fiber-optic structural health monitoring system

We have developed a novel fiber-optic structural health monitoring system using fiber Bragg grating (FBG) sensors. This system enables not only to measure strain at fast speed over several kHz but also to detect acoustic emission and ultrasonic wave. Compared with conventional structural health monitoring system, this system has great advantage that sensory network can be quite simplified from the multifunctionality and multiplexibility of FBGs. The figure shows response signal of FBG sensor and conventional piezoelectric sensor in an ultrasonic damage detection test. As shown in the figure, FBG sensors have better damage detectability than conventional piezoelectric sensors.

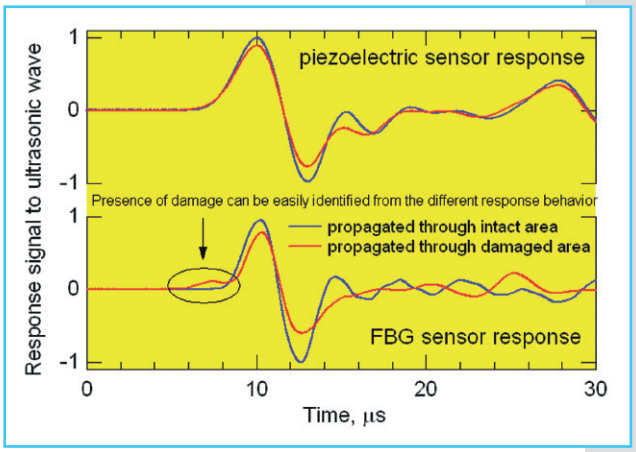

Fig. Example of ultrasonic damage detection test.

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Supersensitive two-photon absorption material

Seeking for materials efficiently absorbing two photons simultaneously

It has been believed that a molecule absorbs one photon on its photoexcitation. This is true for most cases. However, under strong irradiation of light like a pulsed laser beam, two photons are absorbed at the same time by a single molecules—this is two-photon absorption (TPA). Generally organic dyes show very weak TPA. We developed dyes exhibiting very strong TPA. The dyes consist of diacethylene derivatives and is stable compared to other TPA dyes. The dyes also show drastic increase of the TPA sensitivity for visible ray because of the mechanism called resonance enhancement (near double resonance). These supersensitive TPA dyes have high potential for the application such as high-density optical storage, 3D-microfabricaion, and photodynamic therapy.

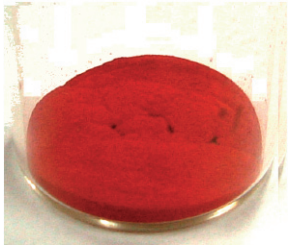

Fig.1 High-sensitive two-photon absorptive compound and its morecular structure.

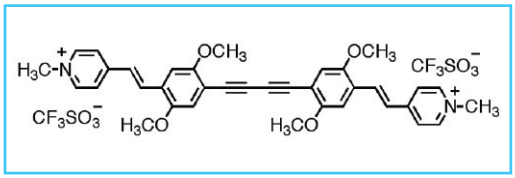

Fig.2 Two-photon absorption spectrum of the diacetylene compound.

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