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Reversible Photo-Induced Deformation of Amorphous Carbon Nitride Films and their Potential Application to Light Driven Actuators

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Amorphous carbon nitride (a-CN_x) films are known as useful coating materials. Recently, we first observed reversible photo-induced deformation of hydrogen-free a-CN_x films under visible light illumination [1]. This phenomenon suggests that the a-CN_x films have potential applications to light driven actuators. In this paper, we report fundamental studies for applying a-CN_x films to light driven actuators.

The hydrogen free a-CN_x films were prepared by reactive radio frequency magnetron sputtering using a graphite target and pure nitrogen gas. The substrate temperature during deposition was kept at 573 K. The substrates used were silicon single crystal plate with the thickness of about 0.5 mm. The self-standing a-CN_x film with the thickness of about 1 μm was obtained by peeling the deposited film from the Si substrate in pure water. The diaphragm with the diameter of 4.6 mm was prepared by sandwiching the self-standing a-CN_x film between metal rings and the movement of the diaphragm was measured using a laser vibrometer under white light illumination.

The photomechanical response was measured when the light illumination is turned on and off with the interval of 15 s, and the results show that the diaphragm reiterates stably and the typical amount of the displacement was about 120 μm. These results suggest that the a-CN_x films have potential for light-driven actuators with good stability.

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[1] M. Aono, T. Harata, N. Kitazawa, Y. Watanabe, *Diamond & Related Materials* **41** (2014) 20-24.