Mesoscopic photomechanical motions achieved by synergetic use of photochemical reactions and photon pressure

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Mesoscopic photomechanical motions have been attracting considerable attention because of their promising applications to ultrafine wireless remote-actuators. To achieve mesoscopic mechanical motions, photoinduced morphological changes of molecular assemblies have been intensively investigated, such as microcrystals and polymer solids. Although photomechanical molecular systems can exhibit variety of flexible motions, precise motional control is relatively difficult because of too many parameters to be simultaneously controlled. Optical tweezer is another approach for achieving mesoscopic photomechanical motions. The experimental parameter of optical tweezer is simple and precise control of mechanical motions can therefore be achieved, while the variety of motion is limited compared with the aforementioned molecular systems.

In the present study, to demonstrate a new series of light-driven small mechanical systems, we propose hybrid systems of laser tweezer (photon pressure) and photochemistry. Small particles under photo-irradiation experience three photon forces: scattering, absorption, and gradient ones. The direction and amplitude of the photon forces depend on not only photoirradiation condition but also photo-response of target materials. We have modified photo-response of small organic particles by using P-type and T-type photochromic reactions. The absorption strength of target particles at the wavelength of laser tweezer were switched through photochromism, leading to nanoscopic reciprocal motion of the optically trapped particles synchronizing with the photochromic reactions.

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[2] K. Setoura, et al., *J. Phys. Chem. C*, **2018**, 122, 22033-22040.