Pulsed Laser Induced Chirality Switching in Tellurium Thin Films

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Technologies based on ultrashort pulsed laser have attracted significant interest recently. In spintronics, all-optical magnetization switching (AOS) has benefited from such technology. In AOS, the magnetization of ferrimagnetic and ferromagnetic thin films is switched by irradiation of ultrashort pulsed laser. The switching can be light helicity dependent or independent, which is primarily determined by the laser pulse intensity as well as the material system.

We have prepared thin films of elemental tellurium (Te), which is known for its chiral crystal structure [1-3], and studied the effects of irradiation of circularly polarized ultrashort pulsed laser on the crystal structure. Te thin films, a few nanometers thick, were deposited using molecular beam epitaxy. Circularly polarized ultrashort laser pulses were generated by a Yb-doped fiber laser. Kerr microscopy is used to study the film structure. The microscopic images showed an optical response that is dependent on the polarization of the incident light. We infer that the image contrast represents the chirality of the crystal structure. Irradiation of pulsed laser changed the image contrast of the Te thin film. The contrast change showed dependence on the laser helicity. In the presentation, we discuss the mechanism behind the optical response of the Te thin films.

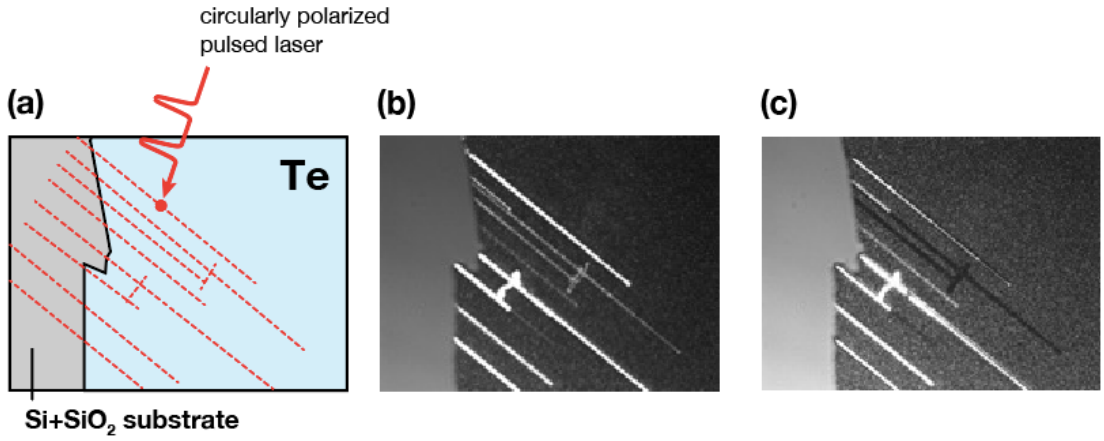

Fig. 1: (a) Schematic illustration of the light irradiation process and (b), (c) Kerr effect microscopy images of a Te thin film with different linear polarizer angles.

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[2] M. Sakano *et al*., Phys. Rev. Lett, 124, 136404 (2020).

[3] T. Furukawa *et al.*, Phys. Rev. Res. 3, 023111 (2021).

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