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Photo-induced Mott metal-insulator transition and oscillation in VO_2 HYUN-TAK KIM, ETRI in Korea, GI-WAN SEO, BONG-JUN KIM, ETRI, YONG WOOK LEE, ETRI and PNU — Since Mott predicted the abrupt first-order metal-insulator transition (MIT) in 1949, one of the most important issues in contemporary solid-state physics has been to experimentally prove Mott's MIT in a strongly correlated system with electron-electron interaction. In particular, in order to reveal the mechanism of the Mott MIT, many physicists have paid attention to a representative paramagnetic insulator, $VO_2(4d^1)$, with an abrupt resistance change near 68°C. The key issue is whether VO_2 is a Mott insulator, in which the abrupt MIT is not caused by a structural phase transition (SPT), or a Peierls insulator undergoing the SPT near $T_{SPT} \approx 68$°C; this question can be answered when a monoclinic metal (MM) phase is observed. Here we show high frequency electrical oscillation a photo-induced MIT and oscillation controlled by adjusting the illumination of infrared light exposed to the VO_2 film in a two-terminal device. The photo-induced MIT is controlled by the intensity of the light and an applying voltage. The oscillations occur in the MM phase of VO_2. The oscillations possibly are generated from a temporal capacitor, which is comprised of both temporary dielectric components, arising from inhomogeneity in a VO_2 film, and MM phases acting like electrodes. This work concludes that the electrical and the optical oscillations are a characteristic of the Mott MIT.

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