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Use of THz FEL for material science

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In a wide range of electromagnetic wave, THz and/or FIR region has both two different aspects such as high-frequency radio waves and low-energy light. From the viewpoint of radio waves, terahertz waves are composed of alternating electromagnetic fields with a period of about ps. Meanwhile, FIR light is a photon comparable to the energy scales of Drude response of free carriers in metals, phonon absorption in crystals, and bonding vibrational and/or rotational motions in molecules. Therefore, next-generation radiation light sources in THz/FIR region with high brilliance and coherence, including few-cycle pulsed light and FEL, can be expected not only as probe light sources but also as pump light sources that cause unique interactions with various materials.

ISIR THz FEL generates monochromatic pulsed light with a wavelength from 30 to 150 μm which corresponds to a photon energy of about 8to 40 meV. The peak power of 20 ps width micro-pulse reaches 4MW. The maximum electric field can be estimated as ~7MV/cm which is comparable to the breakdown field of atmosphere. By using THz FEL, unique excitation phenomena peculiar to THz/FIR lasers, which are different from NIR fs lasers and UV, x-ray, are observed in various materials ranging from inorganic solids to biological constituents[1-3].

References
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