"Novel Techniques for THz-wave measurement

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Our group has been conducting research activities in several directions within the THz field. We introduced many types of widely tunable THz-wave sources using nonlinear optical effects, and we also suggested a whole range of real-life applications using THz-imaging techniques.

Among our studies, a high-resolution tomographic imaging was demonstrated using a reflection-type terahertz time-domain spectroscopy. To realize a practical system for general use, a robust all-fiber laser was used as the pump light source. Broadband terahertz waves were generated with the combination of ultrashort optical pulses using optical fibers and a nonlinear crystals. Using deconvolution signal processing, the wideband spectrum of the generated terahertz waves provided high-axial resolution of 5um leading to tomographic imaging of multilayered structure.

Also, we have started a research project on "influence of widely tunable ultra weak THz/MMW radiation on human skin cells" which is supported by the Ministry of Internal Affairs and Communications in Japan last year. The objective of this research project is to prove the Fröhlich hypothesis which predicts the possible resonant vibrations in cell membrane at a specific frequency around 0.1-1 THz. The cultured cell was irradiated with widely tunable THz wave in order to find the resonant frequency which causes the non-thermal effect combining with this vibration for cell membrane. The cell activity was monitored by AC impedance method and the MTT assay.