

Research highlights

Optical frequency signal propagation and detection via surface plasmon polaritons

Surface plasmon polaritons (SPPs) are waves that propagate along the surface of a conductor and collective oscillation of electrons coupled with optical fields on the nanometer scale, beyond the diffraction limit of propagating light waves.

Many researchers have tried to transmit optical signals through SPPs for application to photonic integrated circuits. However, optical frequency signal transmission has not been examined as yet.

Now, Mitsuo Fukuda and his group have developed a transmission technique and a SPP detector and demonstrated the feasibility of optical frequency signal transmission via SPPs.

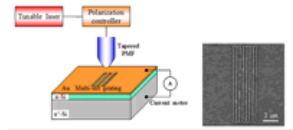
The SPP detector was a Au/silicon Schottky-junction diode, and free electrons excited by SPPs within the Au-metal cross over the junction, thereby generating a photocurrent. Here the detectable wavelength range of light is determined by the height of Schottky barrier. The waveguide of SPPs was fabricated using a thin Au-film deposited onto a silica substrate, and optical heterodyne detection technique was employed to detect optical frequency signal from SPPs.

The Schottky-junction diode detects SPPs corresponding to light even in the 1550-nm-wavelength band, in contrast to conventional silicon photodetectors which use interband electron transition, and cannot detect light of wavelengths of more than 1000 nm. The SPPs converted from 1550-nm-wavelength coherent light carry the optical frequency signal along the surface of Au-film without any coherence degradation.

This device and technique could find applications to nano-scale photonic integrated circuits for processing large amounts of information at high speeds.

Reference:

- Authors: Takuma Aihara and Mitsuo Fukuda.
- Title of original paper: Transmission properties of surface-plasmon-polariton coherence.
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SPP detector developed.



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