We are studying aiming at the chemical sensor which detects a medium with high refractive index \((n > 1.45)\) using excitation of the surface plasmon polariton (SPP) with metal-semiconductor contact. The refractive index of a semiconductor is higher than that of transparent materials like glass and sapphire, and the semiconductors such as GaP and GaN have transparent character in the visible and the near-ultraviolet light region. By combining a semiconductor material and a metallic thin film, the excitation of the SPP is expectable at the metal-semiconductor contact. On the other hand, by the attenuated total reflectance method using Kretschmann arrangement the researches on the application to the chemical sensor are carried out. However, due to using total reflection, the detection of the reflection light from the medium which the refractive index is higher than 1.45 such as carbonic acid \((n = 1.65)\) is difficult. In this study, GaP which is transparent in the visible and the 30-nm-thick Au film is most effective for the system of GaP/Au/H\(_2\)O and GaP/Au/C\(_2\)H\(_5\)OH.

In summary, in order to apply the Au-GaP contacts to the SPP chemical sensors for high refractive index, the reflectance depending on the thickness of Au is examined. From these results, the 30-nm-thick Au film is most effective for the system of GaP/Au/H\(_2\)O and GaP/Au/C\(_2\)H\(_5\)OH. The generation of the SPP is expectable at the metal-semiconductor contact. The refractive index of a semiconductor is higher than that of transparent materials like glass and sapphire, and the semiconductors such as GaP and GaN have transparent character in the visible and the near-ultraviolet light region. By combining a semiconductor material and a metallic thin film, the excitation of the SPP is expectable at the metal-semiconductor contact. On the other hand, by the attenuated total reflectance method using Kretschmann arrangement the researches on the application to the chemical sensor are carried out. However, due to using total reflection, the detection of the reflection light from the medium which the refractive index is higher than 1.45 such as carbonic acid \((n = 1.65)\) is difficult. In this study, GaP which is transparent in the visible and the 30-nm-thick Au film is most effective for the system of GaP/Au/H\(_2\)O and GaP/Au/C\(_2\)H\(_5\)OH.

Acknowledgements
This work is partly supported by Hikari-Mirai Young Scientist Grant 2010 of Optical Society of Japan and JSPS KAKENHI (Grant Number 24360008 and 25600090).

References