

Dual function of gold grating film in catalytic decomposition of hydrogen peroxide and its real-time monitoring transmission surface plasmon resonance signal

Niigata Univ., Chutiparn Lertvachirapaiboon, Akira Baba, Kazunari Shinbo,

Keizo Kato

E-mail: chutiparn.l@eng.niigata-u.ac.jp

Gold-coated grating substrate have been used for catalytic decomposition of hydrogen peroxide (H_2O_2) and for detection of dielectric of silver nanoprisms (AgNPrs) solution change due to oxidation of AgNPrs using transmission surface plasmon resonance (TSPR) technique. The decomposition of H_2O_2 employing gold grating film as a catalyze was 2 times faster than without gold catalyze. These were observed by changing in Δ intensity of TSPR peak at the wavelength of 745 nm as a function of time. Since this system was very sensitive to H_2O_2 , we further utilized this system to quantify glucose through the glucose-oxidase system. Figure 1A shows TSPR spectra of AgNPrs (black solid line) and AgNPrs in the presence of 100 μM glucose with (red solid line) and without (black dashed line) gold catalysis. The decomposition of AgNPrs was caused by generated H_2O_2 from enzymatic oxidation of glucose using glucose oxidase enzyme. When the AgNPrs was decomposed, the increase in TSPR intensity was observed. At glucose concentration of 100 μM (Figure 1A), the Δ intensity of TSPR peak at the wavelength of 745 nm of the system with gold catalysis was greater than without gold catalysis for 4.4 times. More interestingly, at a glucose concentration of 20 μM , with gold catalysis, the Δ intensity of TSPR peak was greater than without gold catalysis for 20.4 times. Figure 1B shows plot of Δ intensities of the systems with (red dot plot) and without (black dot plot) gold catalysis as a function of glucose concentration. With gold catalysis, the significant improvement of sensitivity of glucose detection was observed. We believe that the developed technique is reliable and practical for applications in the field of biochemical analysis and clinical diagnosis.

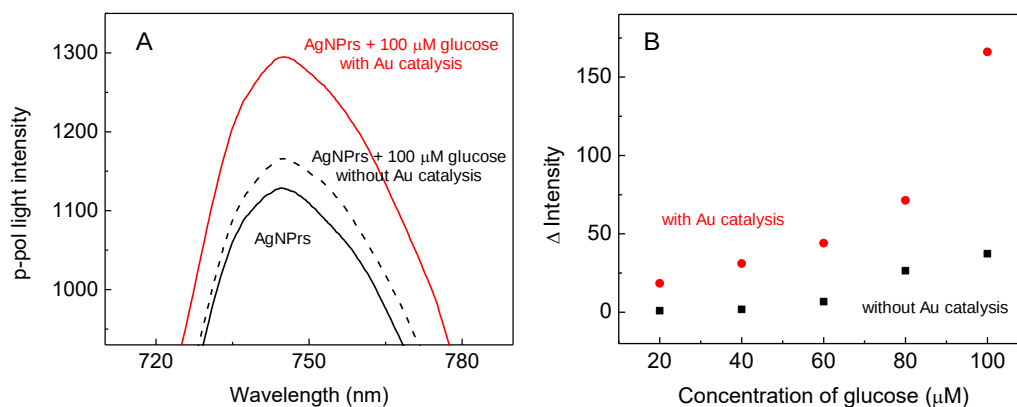


Figure 1. (A) TSPR spectra of AgNPrs (black solid line) and AgNPrs in the presence of 100 μM glucose with (red solid line) and without (black dashed line) gold catalysis. (B) Plot of Δ intensities of the systems with (red dot plot) and without (black dot plot) gold catalysis as a function of glucose concentration.

References

- J. Weiss, Trans. Faraday Soc., 31 (1935) 1547-1557.
- W. He, et al., Biomaterials, 34 (2013) 765-773.
- C. Lertvachirapaiboon, et al., Biosens. Bioelectron., 99 (2018) 399-415.