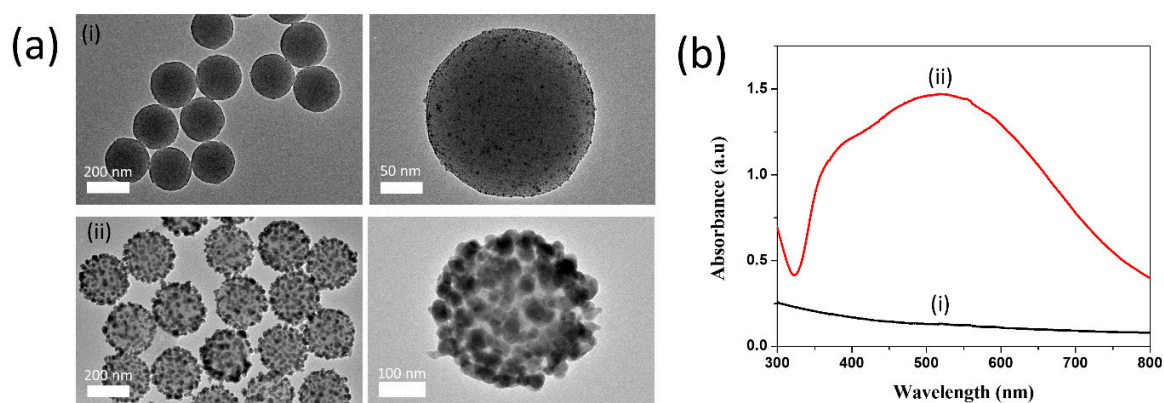
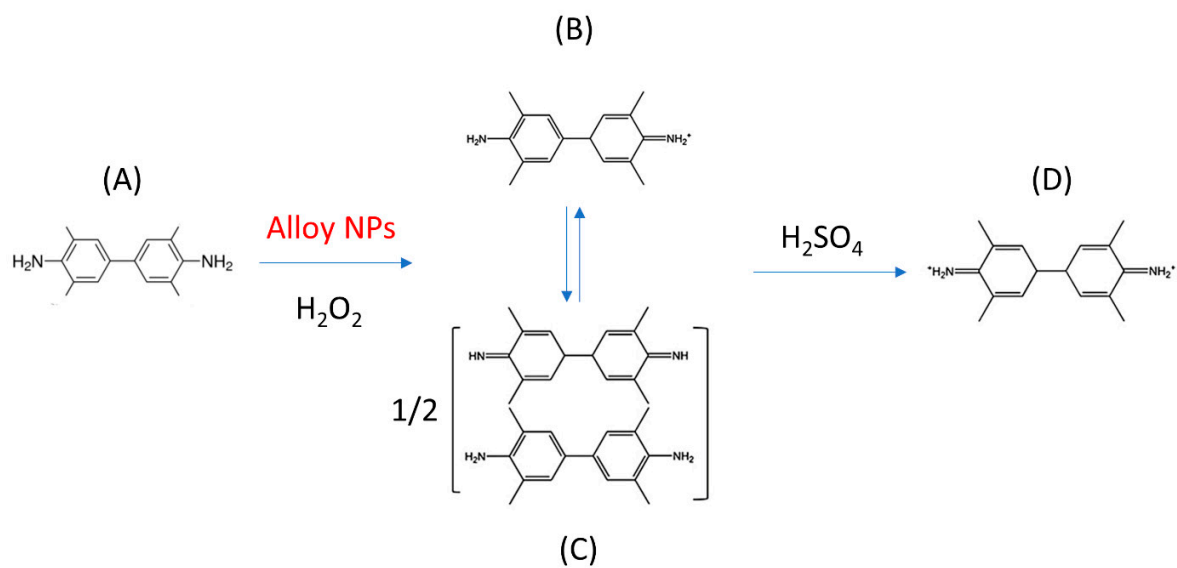


# Nonenzymatic Hydrogen Peroxide Detection Using Surface-Enhanced Raman Scattering of Gold–Silver Core–Shell-Assembled Silica Nanostructures

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**Figure S1.** (a) Transmission electron microscopy images and (b) ultraviolet–visible extinction Scheme 2. Au (1 mg/mL) and (ii) SiO<sub>2</sub>@Au@Ag alloy nanoparticles (NPs) (20 μg/mL) synthesized using 2 mg SiO<sub>2</sub>@NH<sub>2</sub> and 300 μM Ag<sup>+</sup>.



A: TMB

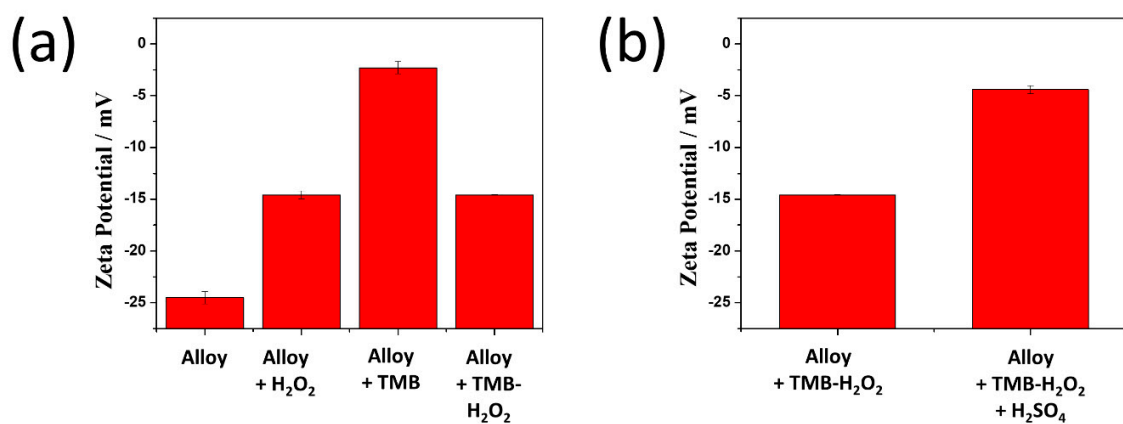
B: TMB $^+$

C: Charge transfer complex of TMB

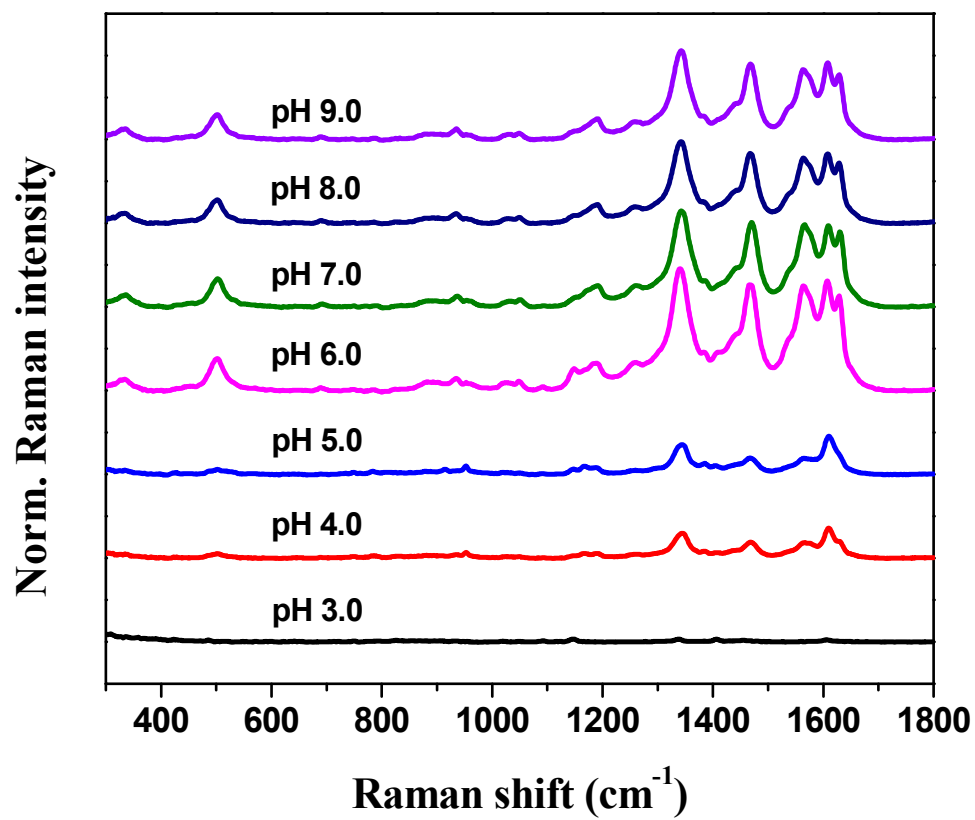
D: TMB $^{2+}$

Alloy NPs:  $\text{SiO}_2@\text{Au}@\text{Ag}$

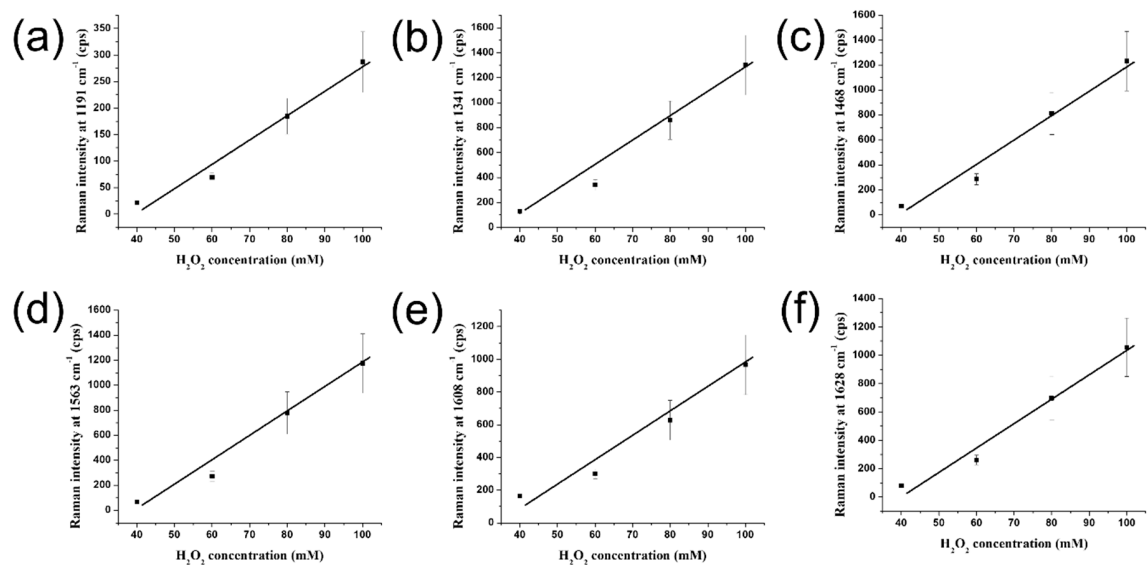
**Figure S2.** Schematic illustration of the catalytic mechanism of  $\text{SiO}_2@\text{Au}@\text{Ag}$  alloy NPs in the TMB- $\text{H}_2\text{O}_2$  mixture. TMB is oxidized to oxTMB by  $\text{SiO}_2@\text{Au}@\text{Ag}$  alloy NPs that act as peroxidase in the presence of  $\text{H}_2\text{O}_2$ . Next, oxTMB is converted to TMB $^{2+}$  in the acidic condition.



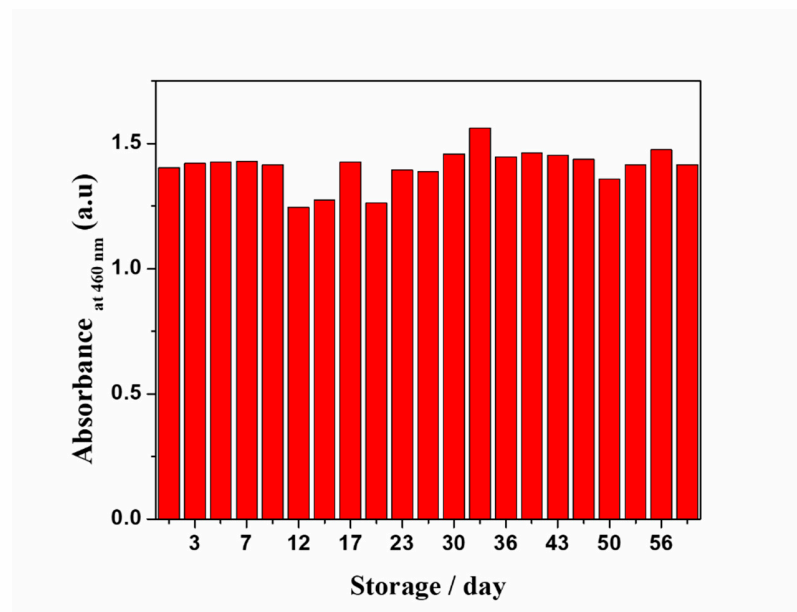
**Figure S3.** (a) Zeta potential of SiO<sub>2</sub>@Au@Ag alloy NPs alone and SiO<sub>2</sub>@Au@Ag alloy NPs in the presence of H<sub>2</sub>O<sub>2</sub>, TMB, and a mixture of TMB and H<sub>2</sub>O<sub>2</sub>. (b) Zeta potential of SiO<sub>2</sub>@Au@Ag alloy NPs in a mixture of TMB and H<sub>2</sub>O<sub>2</sub> before and after the addition of H<sub>2</sub>SO<sub>4</sub>.



**Figure S4.** Surface-enhanced Raman spectroscopy signals of SiO<sub>2</sub>@Au@Ag alloy NPs in various pH solutions, with pH ranging from 3.0 to 9.0 in the TMB-H<sub>2</sub>O<sub>2</sub> mixture.



**Figure S5.** Calibration curves of SERS signal at (a) 1191, (b) 1341, (c) 1468, (d) 1563, (e) 1608, and (f) 1628  $\text{cm}^{-1}$  of  $\text{SiO}_2@\text{Au}@\text{Ag}$  alloy NPs in the TMB- $\text{H}_2\text{O}_2$  mixture with the concentrations of  $\text{H}_2\text{O}_2$  ranging from 40 to 100 mM.



**Figure S6.** Long-term storage of 200  $\mu\text{g/mL}$   $\text{SiO}_2\text{@Au@Ag}$  alloy NPs at 4  $^\circ\text{C}$  in ethanol solution.