# Synthesis of gold–platinum core–shell nanoparticles assembled on a silica template and their peroxidase nanozyme properties

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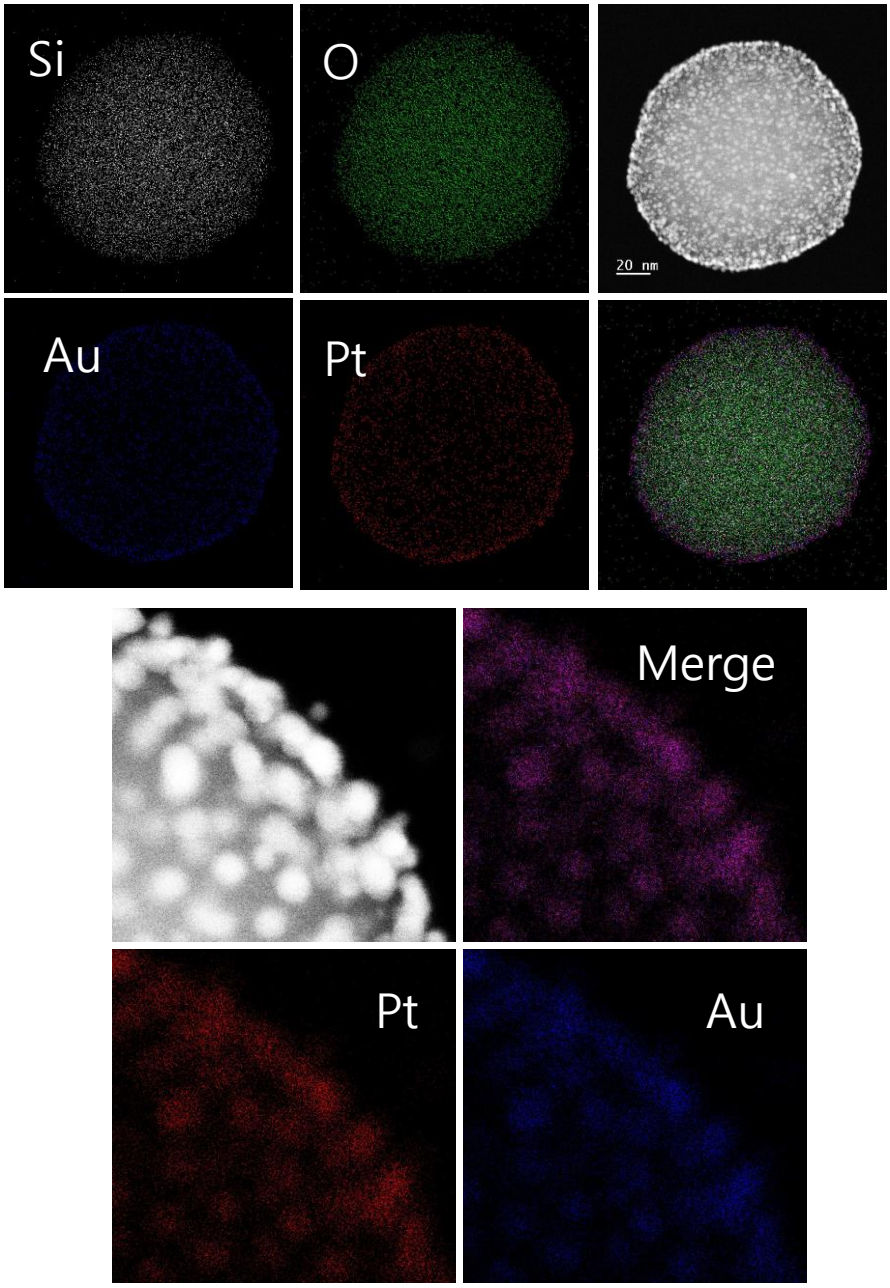



**Figure S1.** Energy-dispersive X-ray spectroscopy mapping of $SiO_2$@Au@Pt for the $SiO_2$, Au, and Pt elements. $SiO_2$@Au@Pt was synthesized using 200 μg of $SiO_2$@Au and 200 μM $Pt^{2+}$.

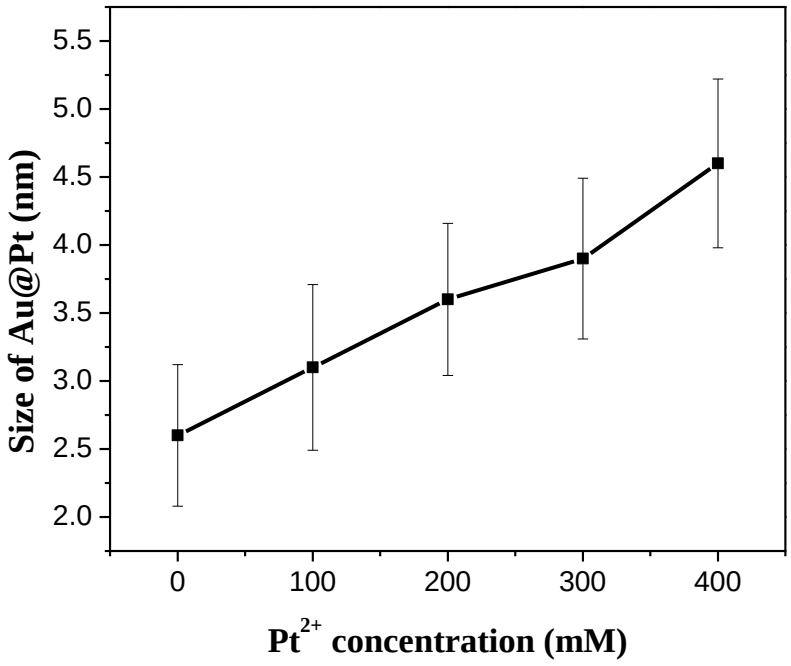



**Figure S2.** Sizes of Au@Pt on the surface of $SiO_2$@Au@Pt synthesized using 200 μg of $SiO_2$@Au and various $Pt^{2+}$ concentrations (from 0 to 400 μM).

**Table S1.** Effects of various $Pt^{2+}$ concentrations on the reciprocal distribution of Pt and Au on the surface of $SiO_2$@Au@Pt synthesized using 200 μg of $SiO_2$@Au and various concentrations of $Pt^{2+}$.

| **$Pt^{2+}$ concentration (μM)** | **Pt** | **Au** | **Reciprocal of Pt and Au** |
|---|---|---|---|
| 0 | 0 | 100 | 0 |
| 100 | 71.59 | 28.41 | 2.5 |
| 200 | 76.4 | 23.6 | 3.2 |
| 300 | 79.92 | 20.08 | 4.0 |
| 400 | 87.07 | 12.93 | 6.7 |

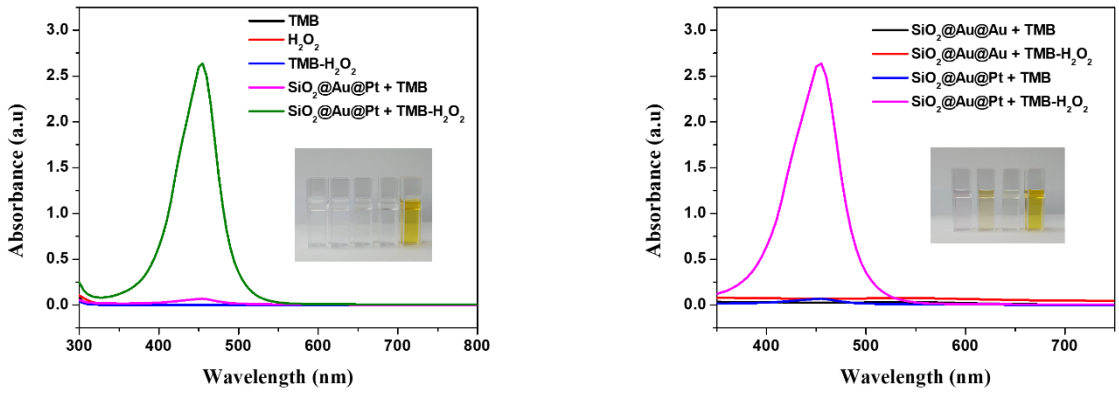



**Figure S3.** (a) UV–Vis absorbance spectra and an optical image (inset) of $SiO_2$@Au@Pt (5 μg) in TMB and $H_2O_2$ solutions. (b) UV–Vis absorbance spectra and an optical image (inset) of $SiO_2$@Au@Pt (5 μg) and $SiO_2$@Au@Au (5 μg) in TMB and TMB-$H_2O_2$ solutions.



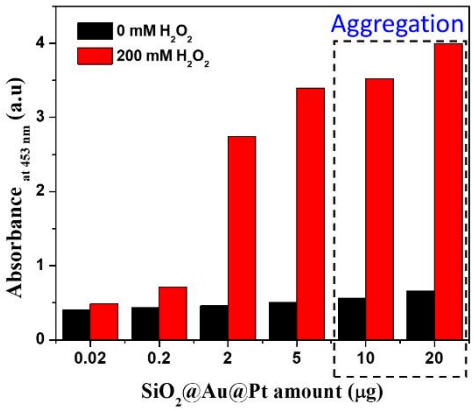



**Figure S4.** Effects of the amount of $SiO_2$@Au@Pt NPs (0.02–20 μg) on the peroxidase-like activity of $SiO_2$@Au@Pt in the presence of 0.6 mM TMB and 200 mM $H_2O_2$ at pH 4.0 in a 15-min reaction. The UV–Vis absorbance plots at 453 nm for each condition represent the absorbance of the oxidized TMB substrate.



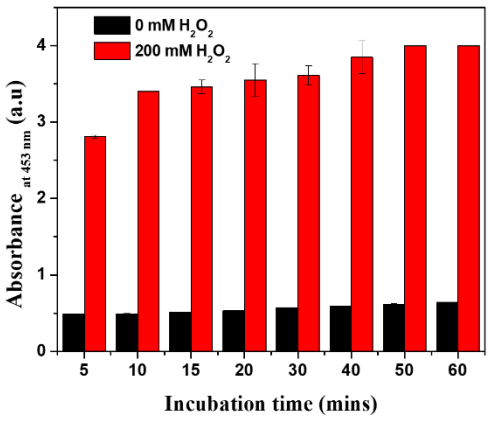



**Figure S5.** Effects of the incubation time (5–60 min) on the peroxidase-like activity of $SiO_2$@Au@Pt in the presence of 0.6 mM TMB and 200 mM $H_2O_2$ at pH 4.0. The UV–Vis absorbance plots of each condition at 453 nm represent the absorbance of the oxidized TMB substrate.

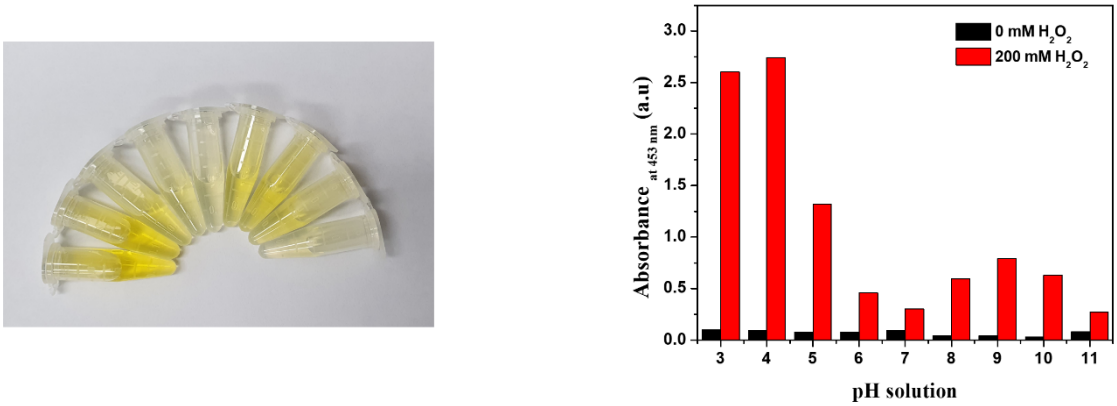



**Figure S6.** Effects of pH (3.0–11.0) on the peroxidase-like activity of $SiO_2$@Au@Pt in the presence of 0.6 mM TMB and 200 mM $H_2O_2$ in a 15-min reaction. The UV–Vis absorbance plots of each condition at 453 nm represent the absorbance of the oxidized TMB substrate.

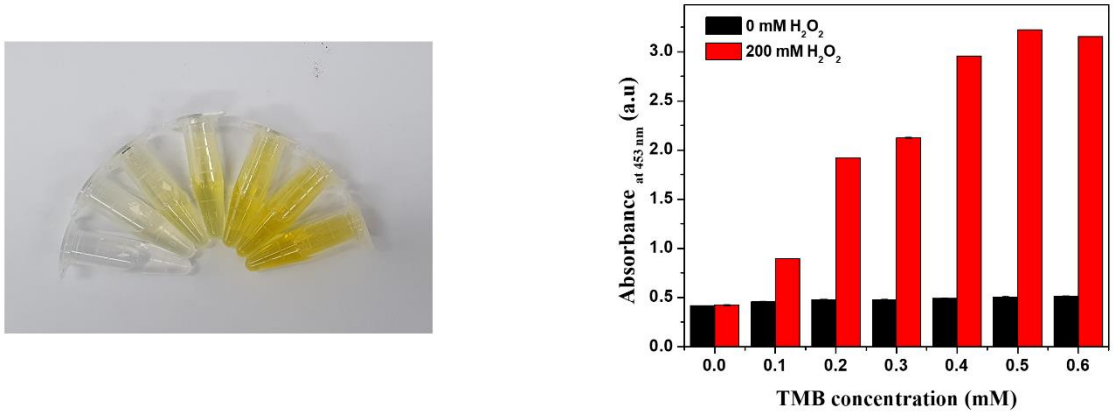



**Figure S7.** Effects of the TMB concentration (0–0.6 mM) on the peroxidase-like activity of $SiO_2$@Au@Pt in the presence of 200 mM $H_2O_2$ at pH 4.0 in a 15-min reaction. The UV–Vis absorbance plots of each condition at 453 nm represent the absorbance of the oxidized TMB substrate.

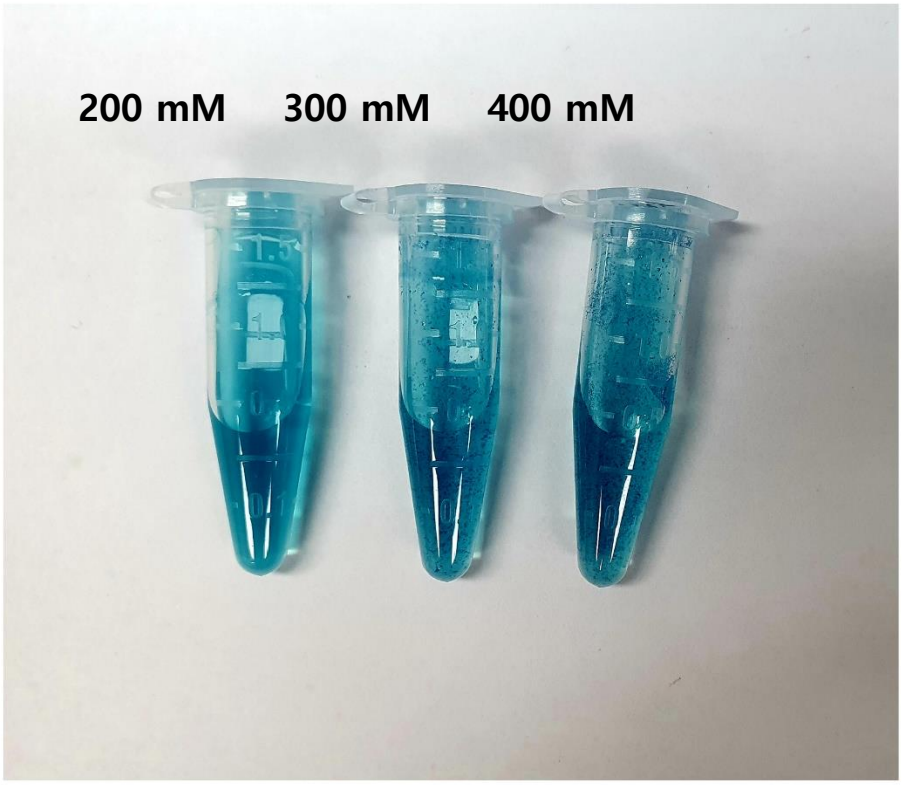



**Figure S8.** Colors of $SiO_2$@Au@Pt@Pt NPs with 200, 300, and 400 mM $H_2O_2$ in the presence of 0.5 mM TMB. The optimized conditions are 5 μg of $SiO_2$@Au@Pt, 0.6 mM TMB, and pH 4.0 in a 15-min reaction.