Electronic Supplementary Material (ESI) for Nanoscale
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Supporting Information

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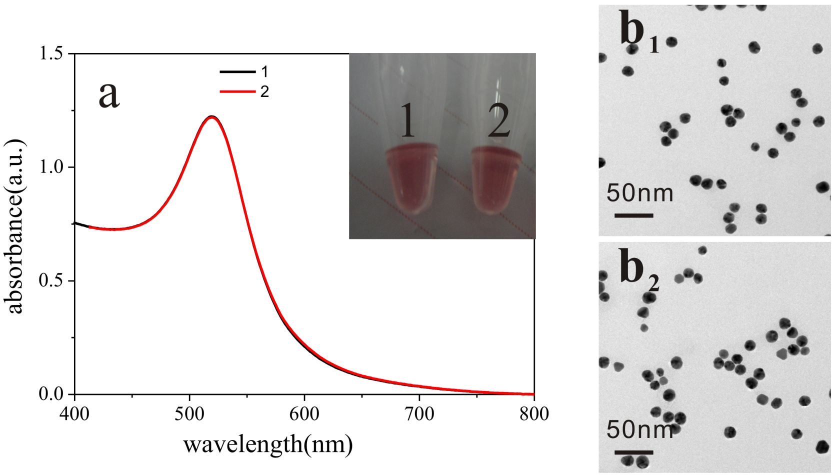

Figure S1. (a) UV-vis spectra of (1) Au NPs suspension and (2) Tween 20/Citrate-Au NPs. The inset shows the corresponding images of color. (b) The TEM images of (b_1) Au NPs suspension and (b_2) Tween 20/Citrate-Au NPs.

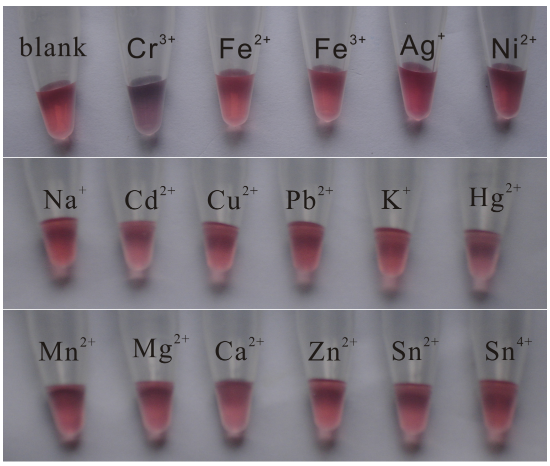

Figure S2. A photograph of the selectivity of using Tween 20/Citrate-Au NPs to detect Cr^{3+}(3 µM). Other metal ions were all used at 100µM.

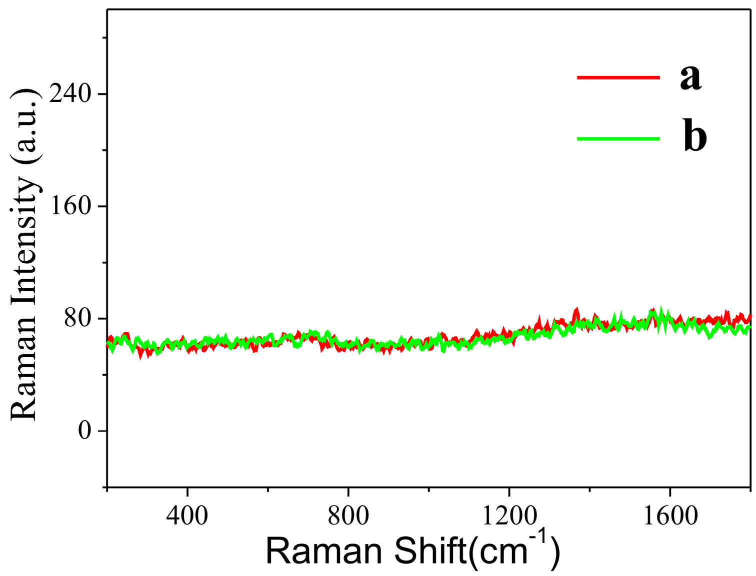

Figure S3. SERS spectra obtained from Tween 20/Citrate-Au NPs (a) in the absence of Cr^{3+} and (b) in the presence of 10 μM Cr^{3+}.

To demonstrate that other moleculars can also be used as the SERS probes, we have replaced 2-ATP with 4-aminothiophenol (4-ATP). And the methods of the preparation of the SERS substrates were the same as that of 2-ATP which acted as SERS probe.The SERS spectra of 4-ATP molecules are shown in figure S4a. The strongest peak at 1083 cm^{-1} is the *v*(C-S) band of the characteristic SERS spectra of 4-ATP.[1] And we chose it as a reference peak for the spectra normalization. Figure S4b plots the SERS intensity at 1083 cm^{-1} versus the concentration of Cr^{3+}. As can be seen in the plot, the SERS signal increases as the concentration of Cr^{3+} increases. This observation is consisted with the previous behaviour of 2-ATP probe molecule.

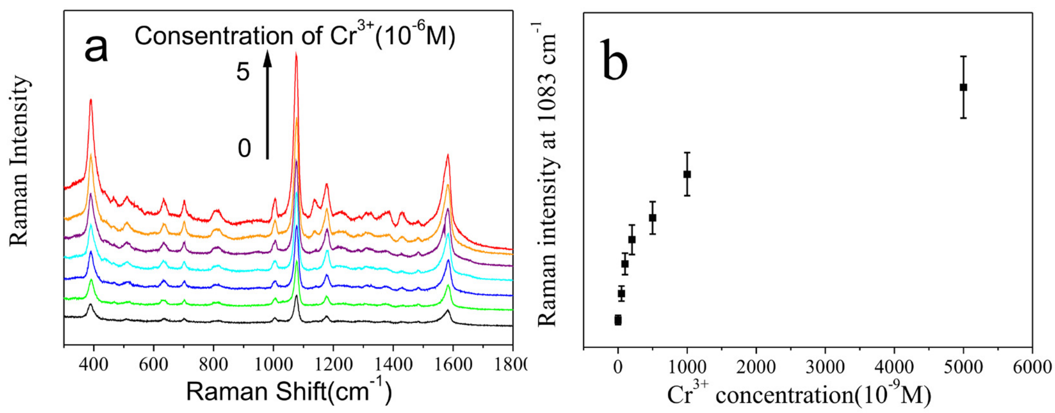

Figure S4. (a) The SERS spectra of 4-ATP obtained from our Cr^{3+}-sensing system in the presence of different concentrations of Cr^{3+} (0-5 × 10^{-6} M: 0 M, 50 × 10^{-9} M, 100 × 10^{-9} M, 200 × 10^{-9} M, 500 × 10^{-9} M, 1 ×10^{-6} M, 5 ×10^{-6} M). (b) Plot demonstrates how Raman intensity at 1083 cm^{-1} changes with the addition of different concentration of Cr^{3+}.

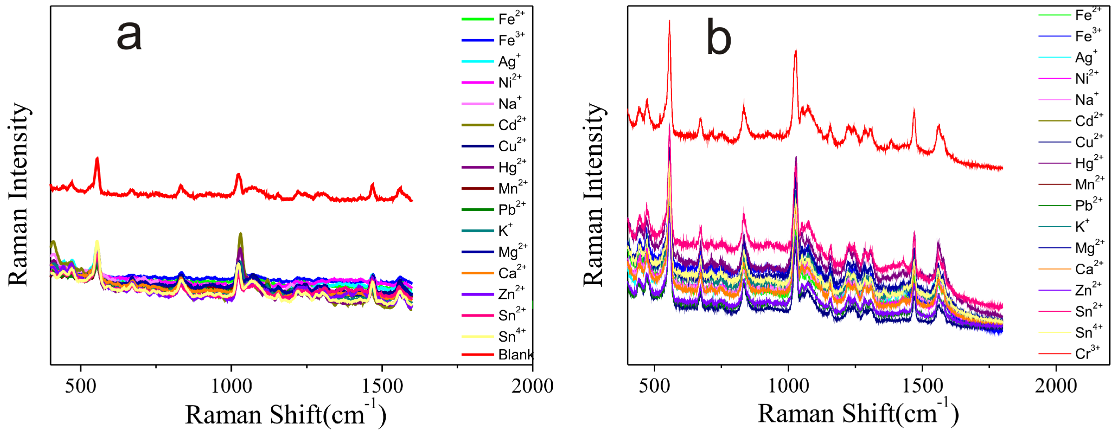

Figure S5. Demonstrating selectivity of our Cr^{3+}-sensing system over other metal ions. (a) The Raman intensity of the sensing systems in the absence of Cr^{3+} or in the presence of other metal ions (20 × 10^{-6} M). (b) The Raman intensity of the sensing systems with the addition of Cr^{3+} (50 × 10^{-9} M) and other metal ions (20 × 10^{-6} M).

1. G. Merga, N. Saucedo, L. C. Cass, J. Puthussery and D. Meisel, *J Phys Chem C*, 2010, **114**, 14811-14818.