# Supporting Information

# *In-situ* Creation of SERS Active Au-$AuO_x$ Nanostructures through Electrochemical Process for Pigments Detection

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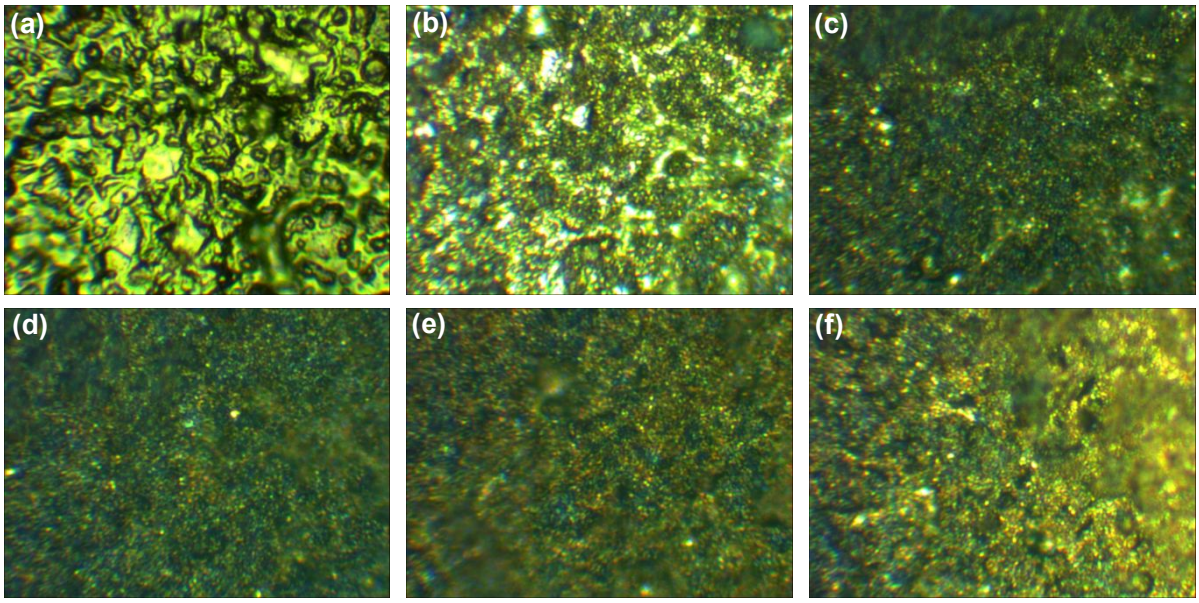


**Figure S1.** Images of optical microscopy of SPE-Au corresponding to different reverse rate in the area of 100×100 μm$^2$. (a) SPE-Au, (b) SPE-Au200, (c) SPE-Au100, (d) SPE-Au50, (e) SPE-Au25 and (f) SPE-Au5.

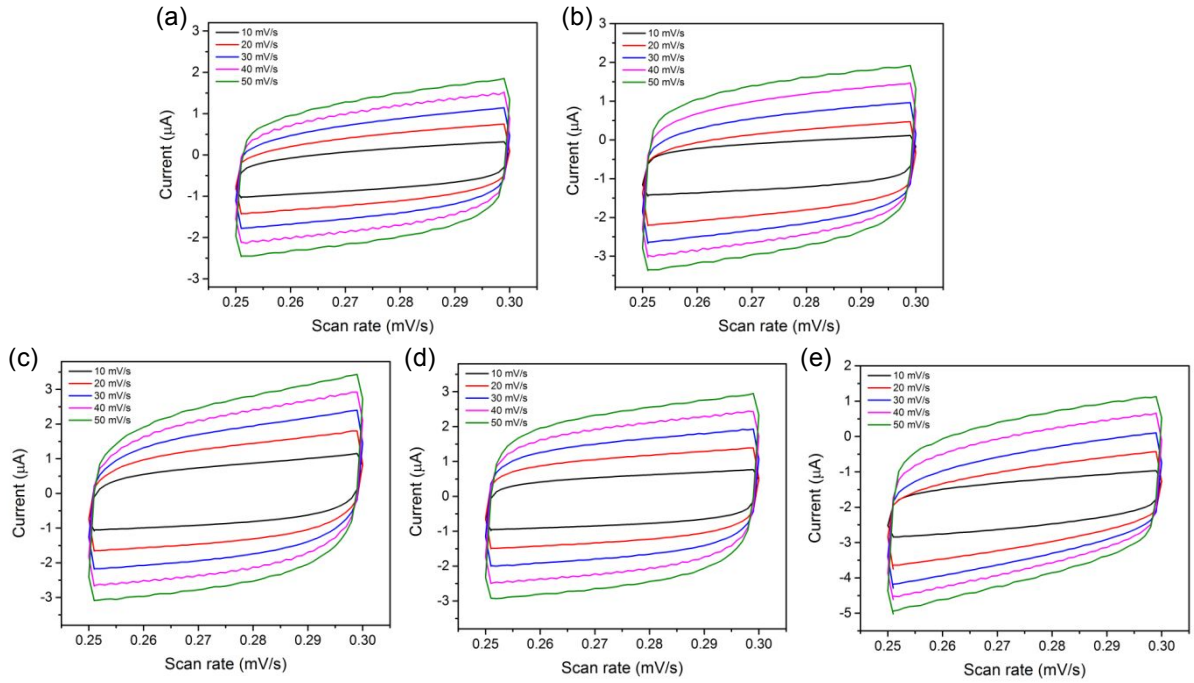


**Figure S2.** CVs in the potential range of Faradaic silence with various scan rates for (a) SPE-Au200, (b) SPE-Au100, (c) SPE-Au50, (d) SPE-Au25 and (e) SPE-Au5.

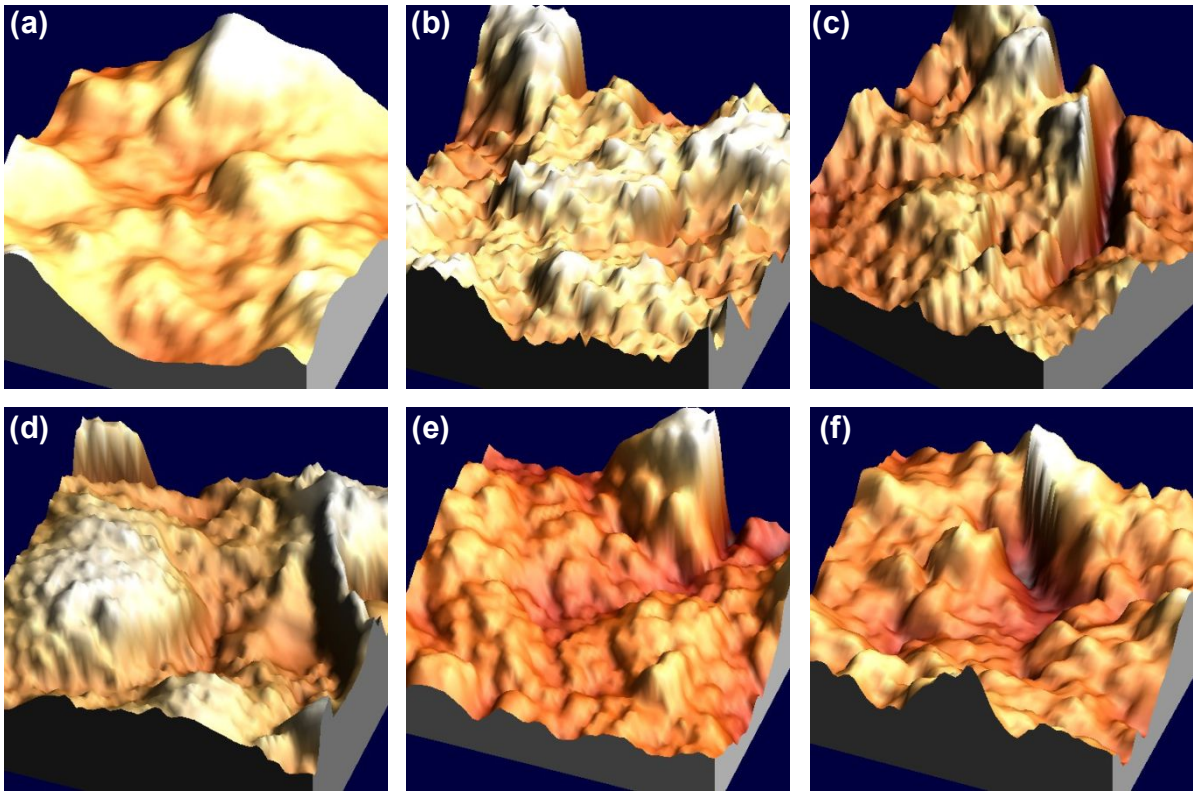


**Figure S3.** AFM images of SPE-Au corresponding to different reverse rates within the area of 20×20 $\mu m^2$. (a) SPE-Au, (b) SPE-Au200, (c) SPE-Au100, (d) SPE-Au50, (e) SPE-Au25 and (f) SPE-Au5.

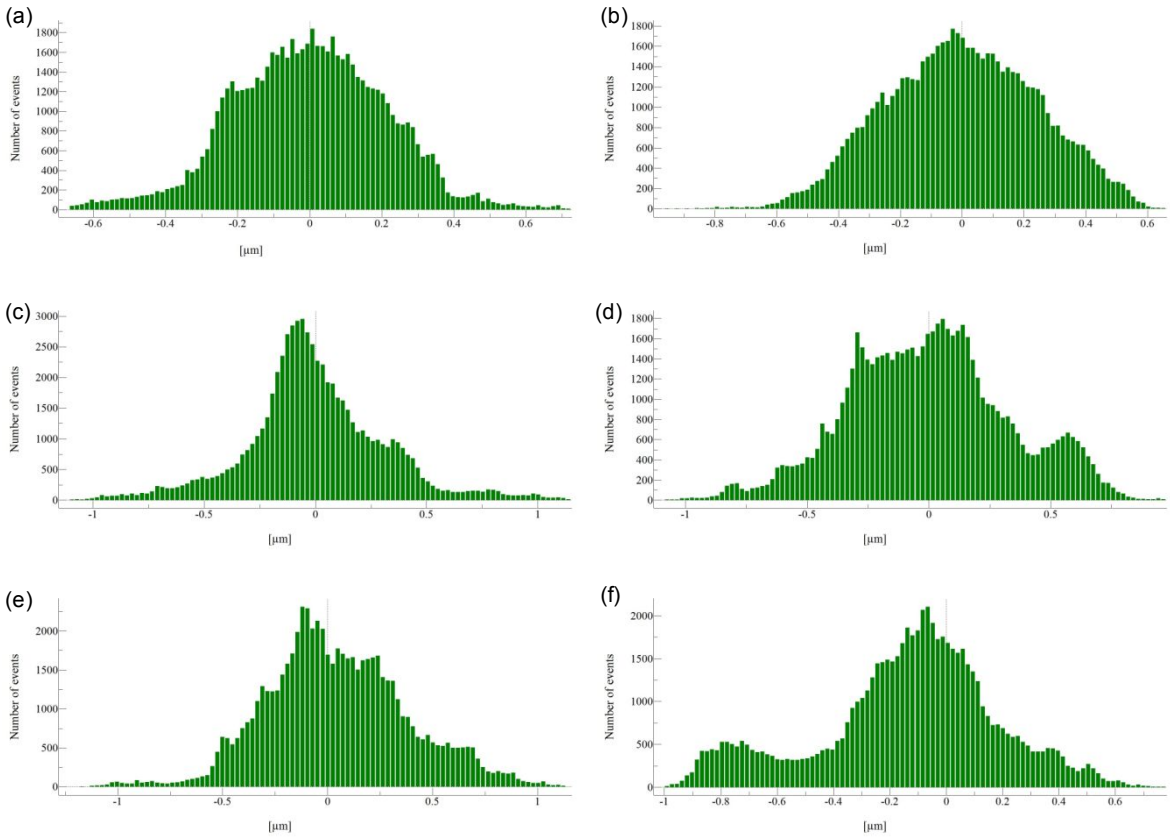


**Figure S4.** Histograms of the distribution of particle size to different reverse rate within the area of 20×20 µm$^2$. (a) SPE-Au, (b) SPE-Au200, (c) SPE-Au100, (d) SPE-Au50, (e) SPE-Au25 and (f) SPE-Au5.

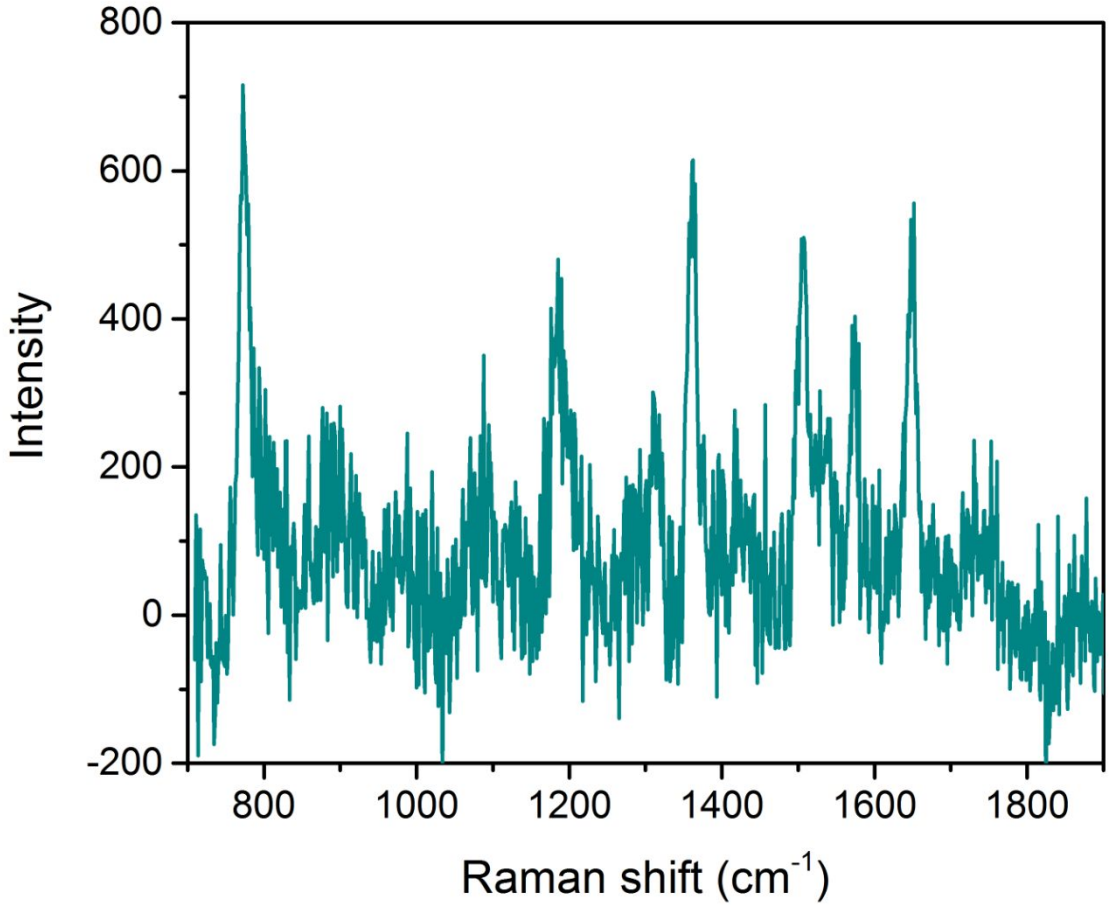


**Figure S5.** Raman spectra of ceramic substrate after adsorbing 0.1 M of R6G.

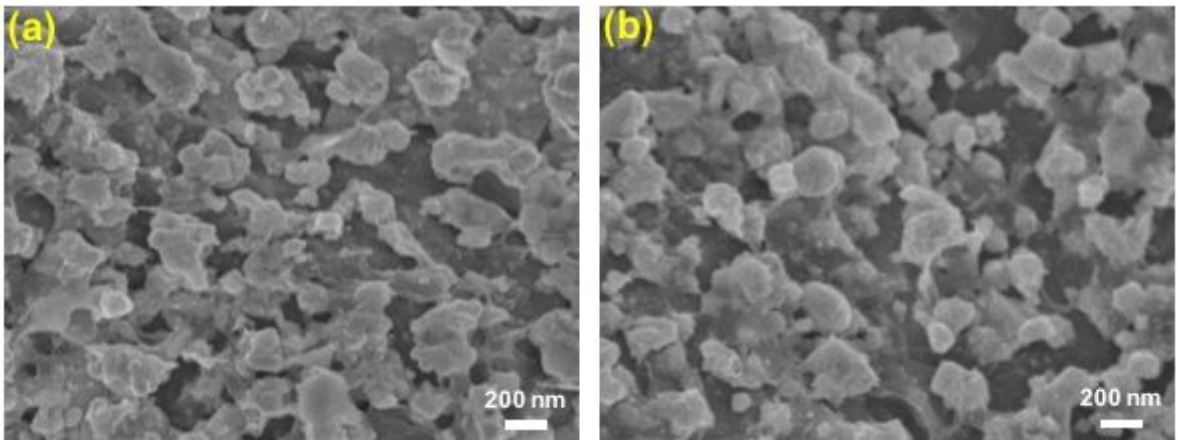


**Figure S6.** SEM images of SPE-Au25 substrates from others two different batches.

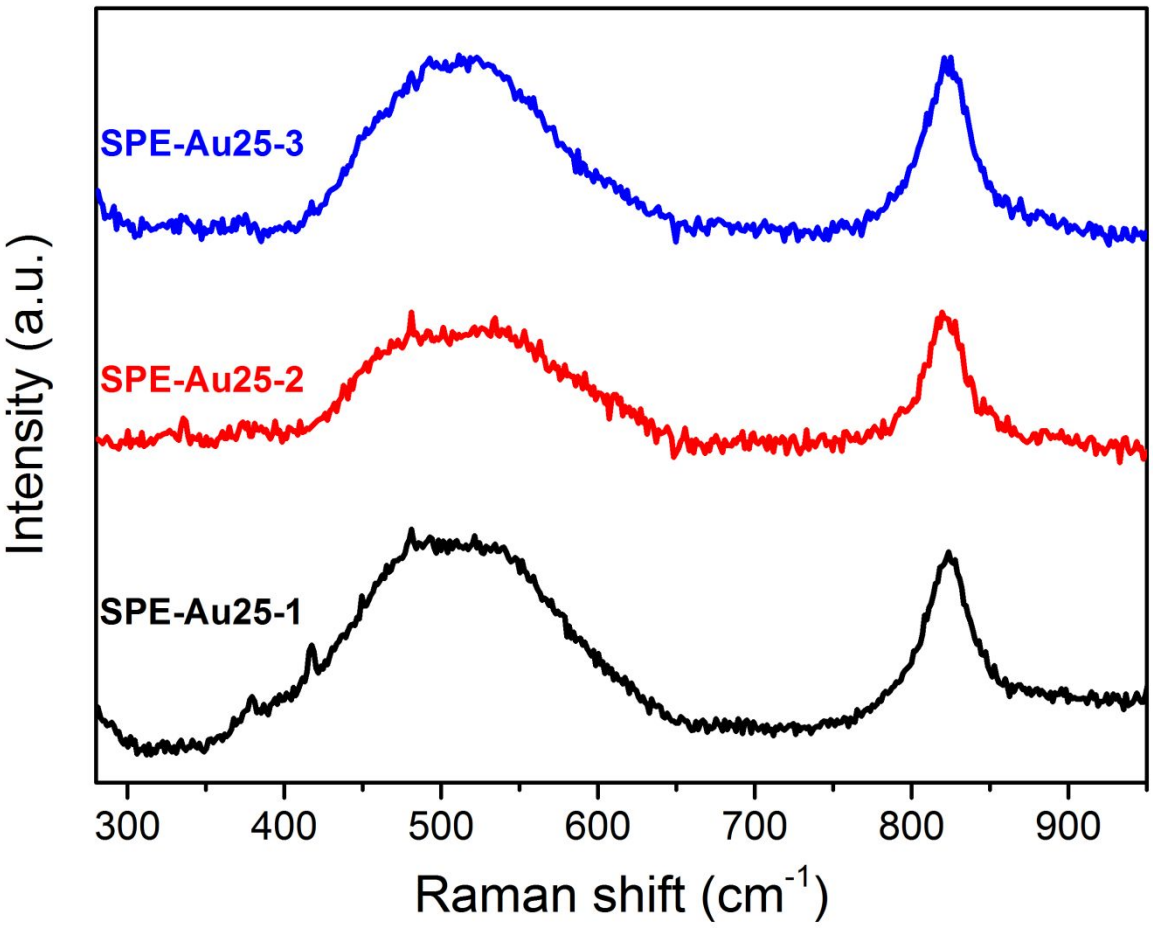


**Figure S7.** Raman spectra of three SPE-Au25 substrates from three different batches.

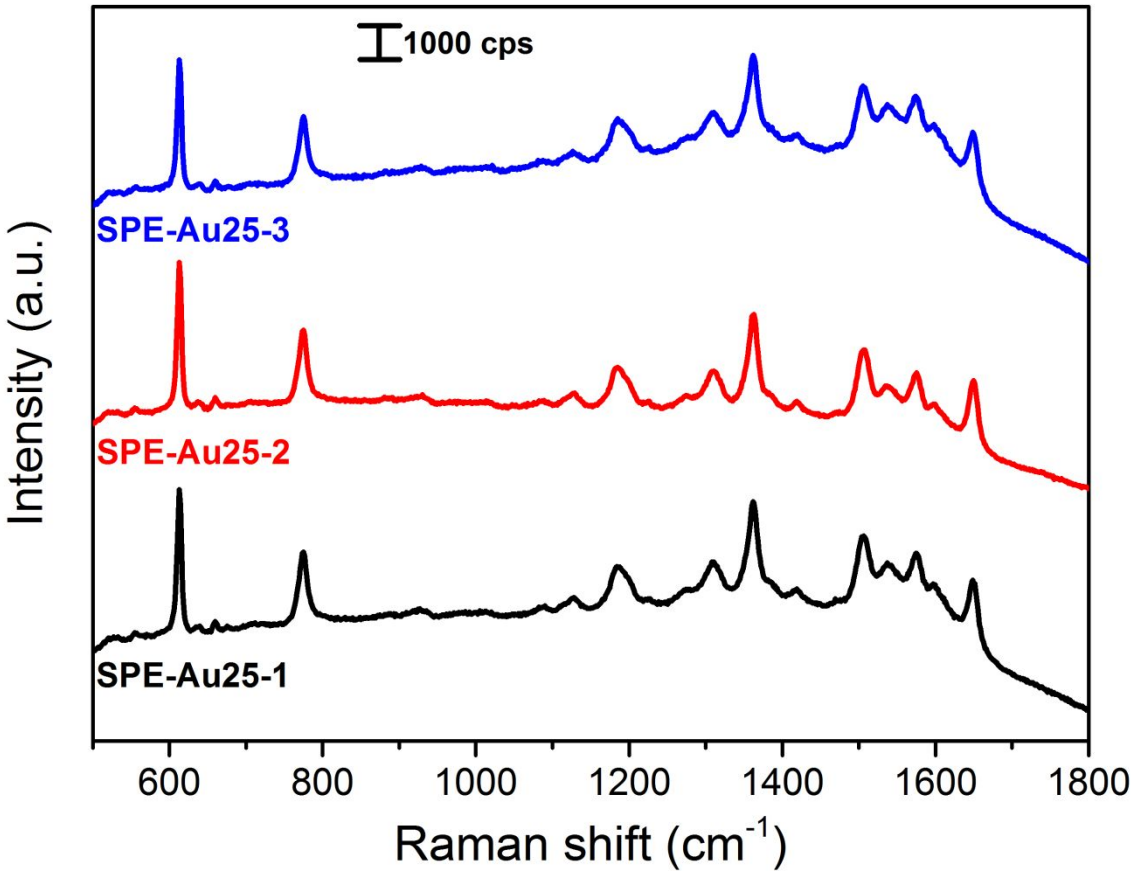


**Figure S8.** Raman spectra of R6G ($10^{-6}$ M) from three different batches of SPE-Au25 substrates.

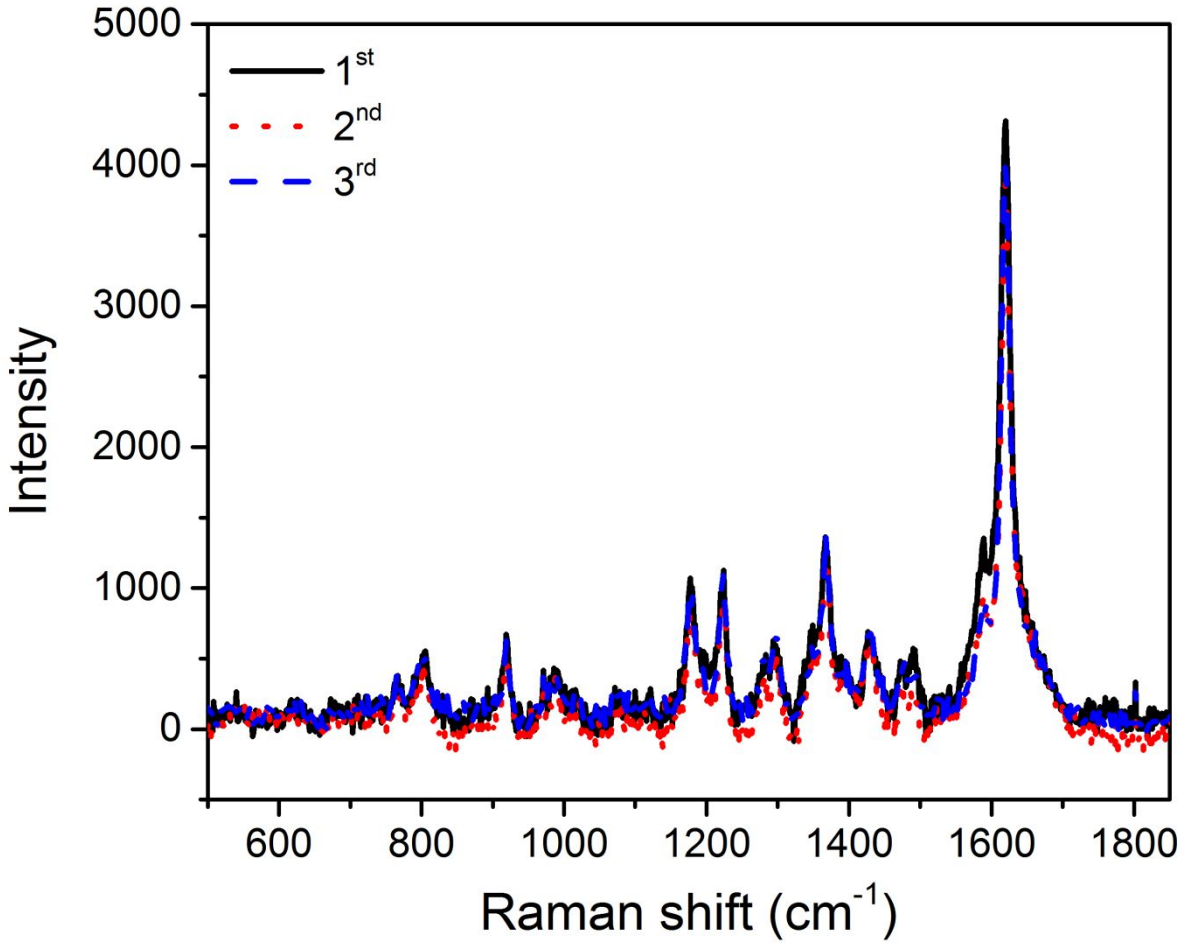


**Figure S9.** SERS spectra of BBF ($10^{-6}$ M) from SPE-Au25 substrate for three individually measurements.

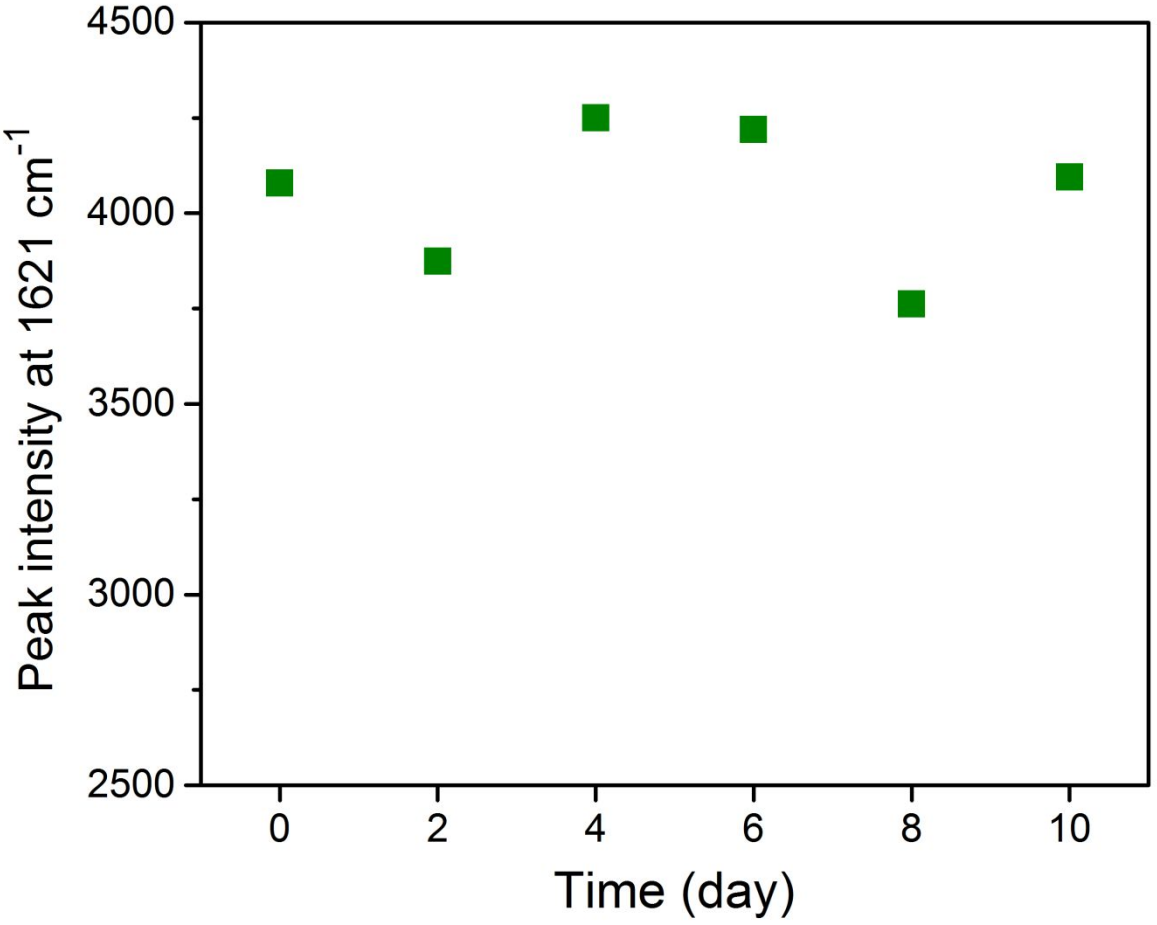


**Figure S10.** Variation of peak intensity at 1621 cm-1 of BBF ($10^{-6}$ M) from SPE-Au25 substrate within 10 days.

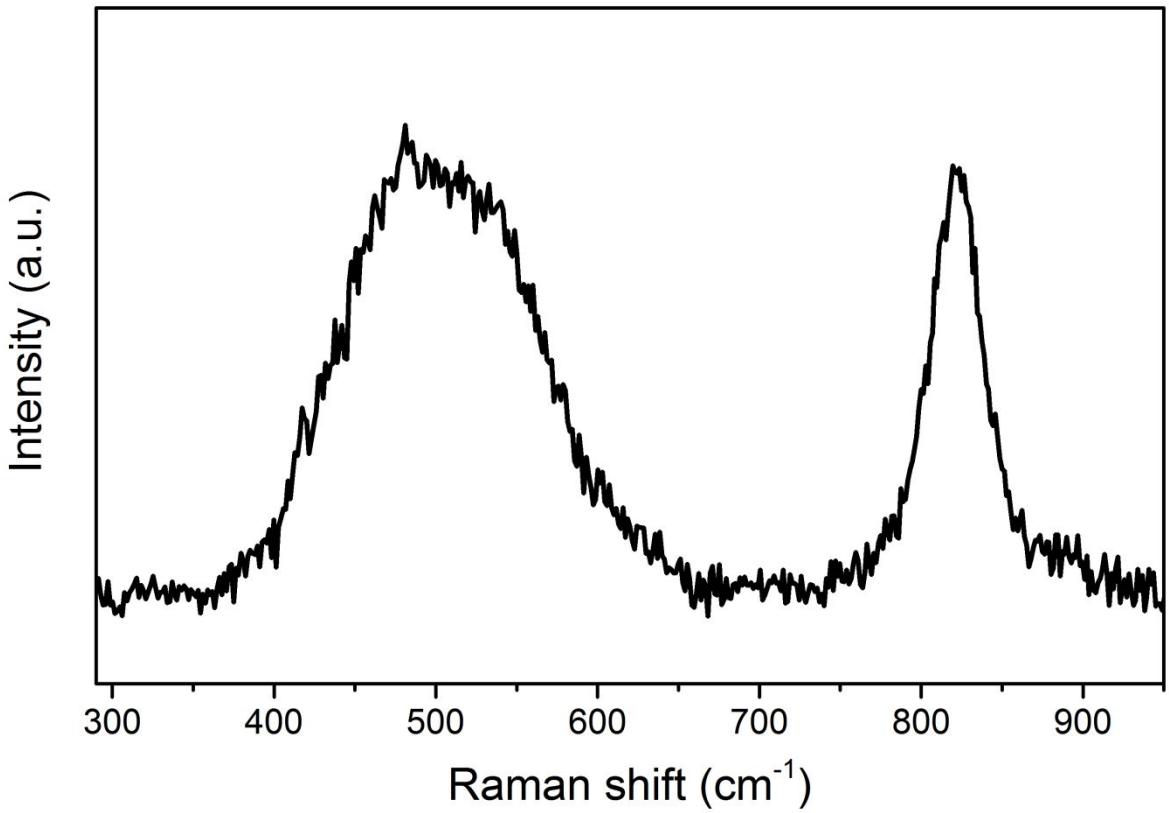


**Figure S11.** Raman spectrum of SPE-Au25 substrate after storing in ambient condition for 10 days.