

*Electronic Supplementary Information (ESI)*

## Effective SERS detection using a flexible wiping substrate based on electrospun polystyrene nanofibers

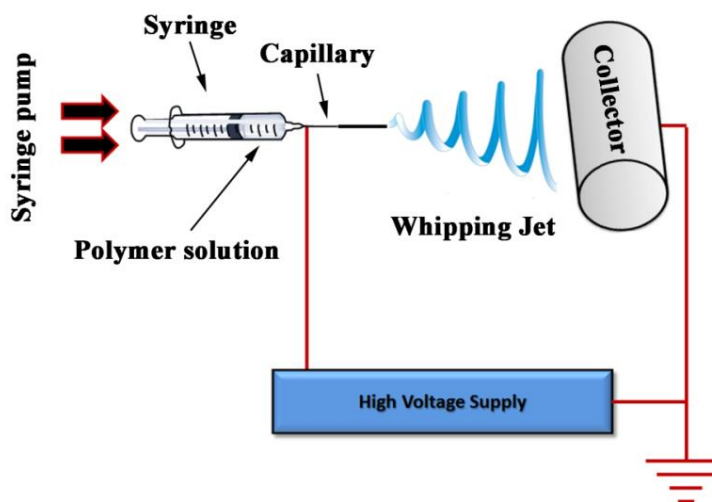
Jalaja K.,<sup>a</sup> Bhuvanewari S.,<sup>b</sup> Manjuantha Ganiga,<sup>a</sup> Divyamol R.,<sup>a</sup> Anup S.,<sup>c</sup>  
Jobin Cyriac\*<sup>a</sup> and Benny K. George\*<sup>b</sup>

<sup>a</sup>Department of Chemistry, Indian Institute of Space Science and Technology, Thiruvananthapuram, 695 547, India

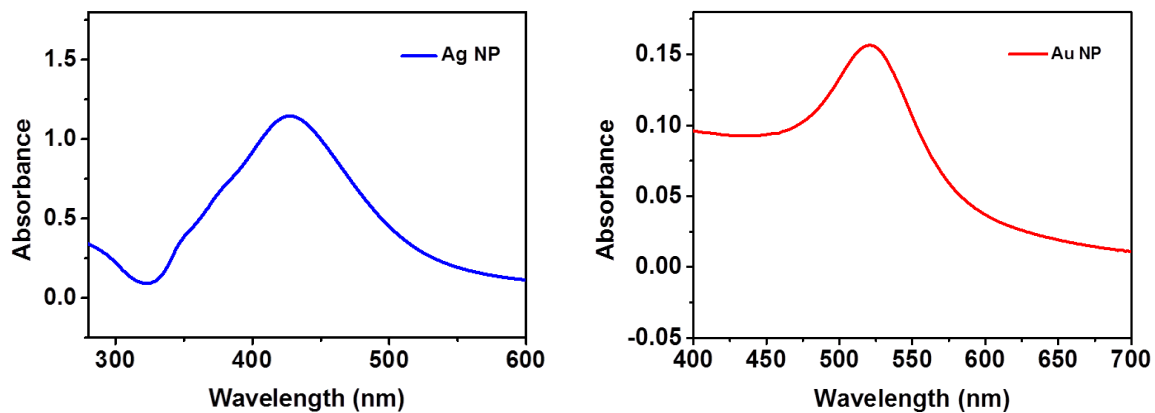
<sup>b</sup>Analytical, Spectroscopy and Ceramics Group, PCM Entity, Vikram Sarabhai Space Centre, Thiruvananthapuram, 695 022, India

<sup>c</sup>Department of Aerospace Engineering, Indian Institute of Space Science and Technology, Thiruvananthapuram, 695 547, India

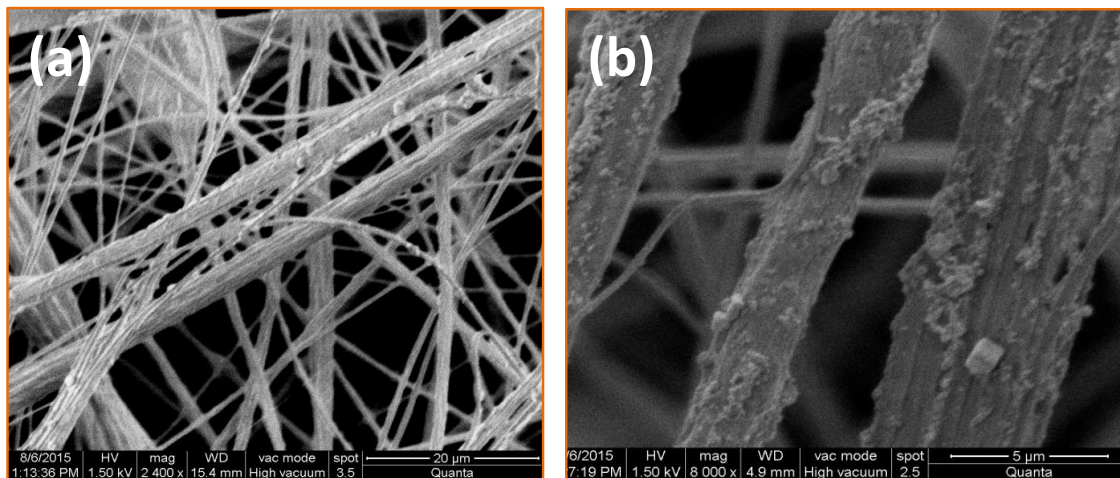
Corresponding authors: [jobincyriac@iist.ac.in](mailto:jobincyriac@iist.ac.in), [benny\\_george@vssc.gov.in](mailto:benny_george@vssc.gov.in)



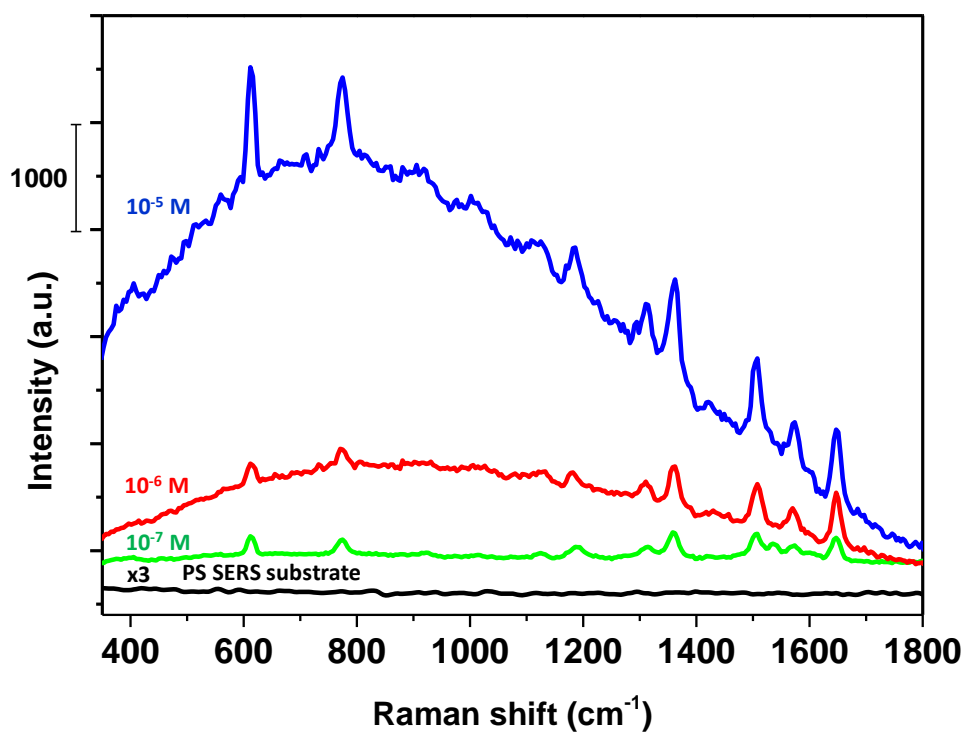
**Figure S1:** Schematic of electrospinning technique. Flow rate: 0.5 mL/h, potential difference between the needle and the collector: 23 kV, tip-collector distance: 15 cm



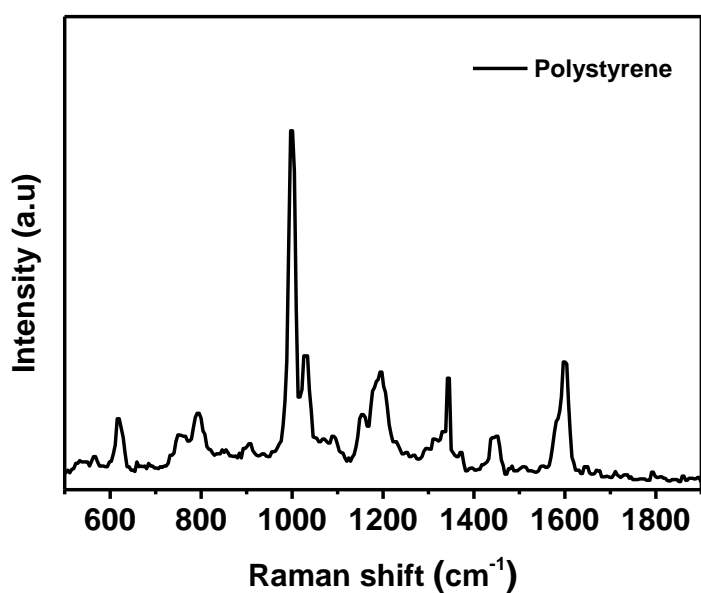
**Figure S2.** UV-visible absorption spectra of Ag NPs ( $\lambda_{\max}$ = 440 nm) and Au NPs ( $\lambda_{\max}$  = 528 nm) colloidal solutions.



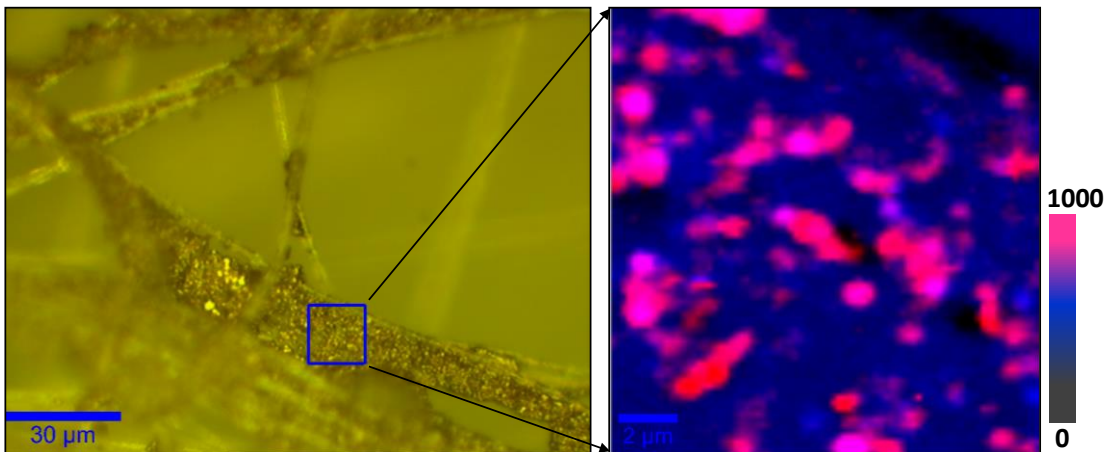
**Figure S3.** SEM images of Au NPs decorated PS nanofibers at two different magnifications.



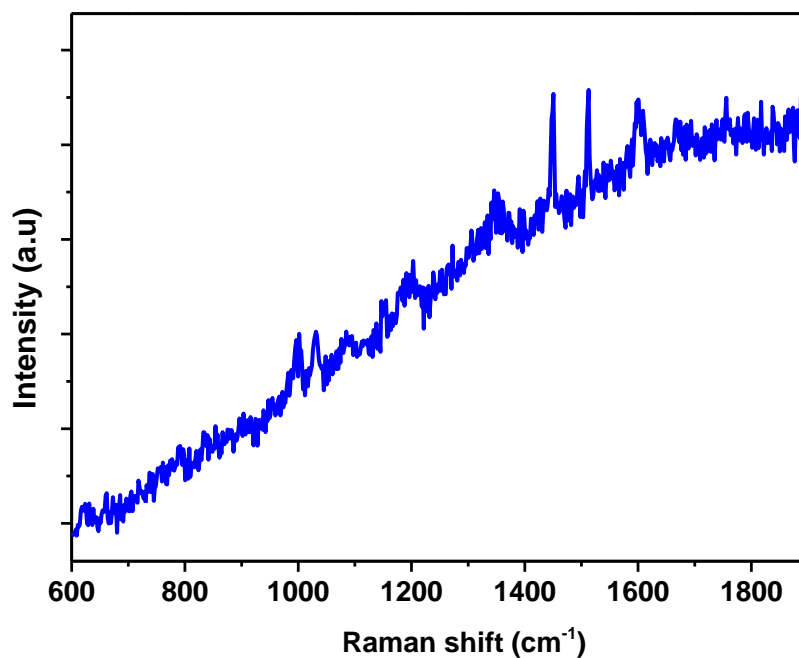
**Figure S4.** SERS spectra of different concentrations of Rhodamine 6G collected using PS SERS substrate. 100  $\mu$ l of each solution was drop casted and dried before collecting the spectra. Blue, red and green traces represent concentration of 10<sup>-5</sup> M, 10<sup>-6</sup> M and 10<sup>-7</sup> M, respectively. Raman spectra of PS SERS substrate (black trace) is given to show that there was no substrate interference.



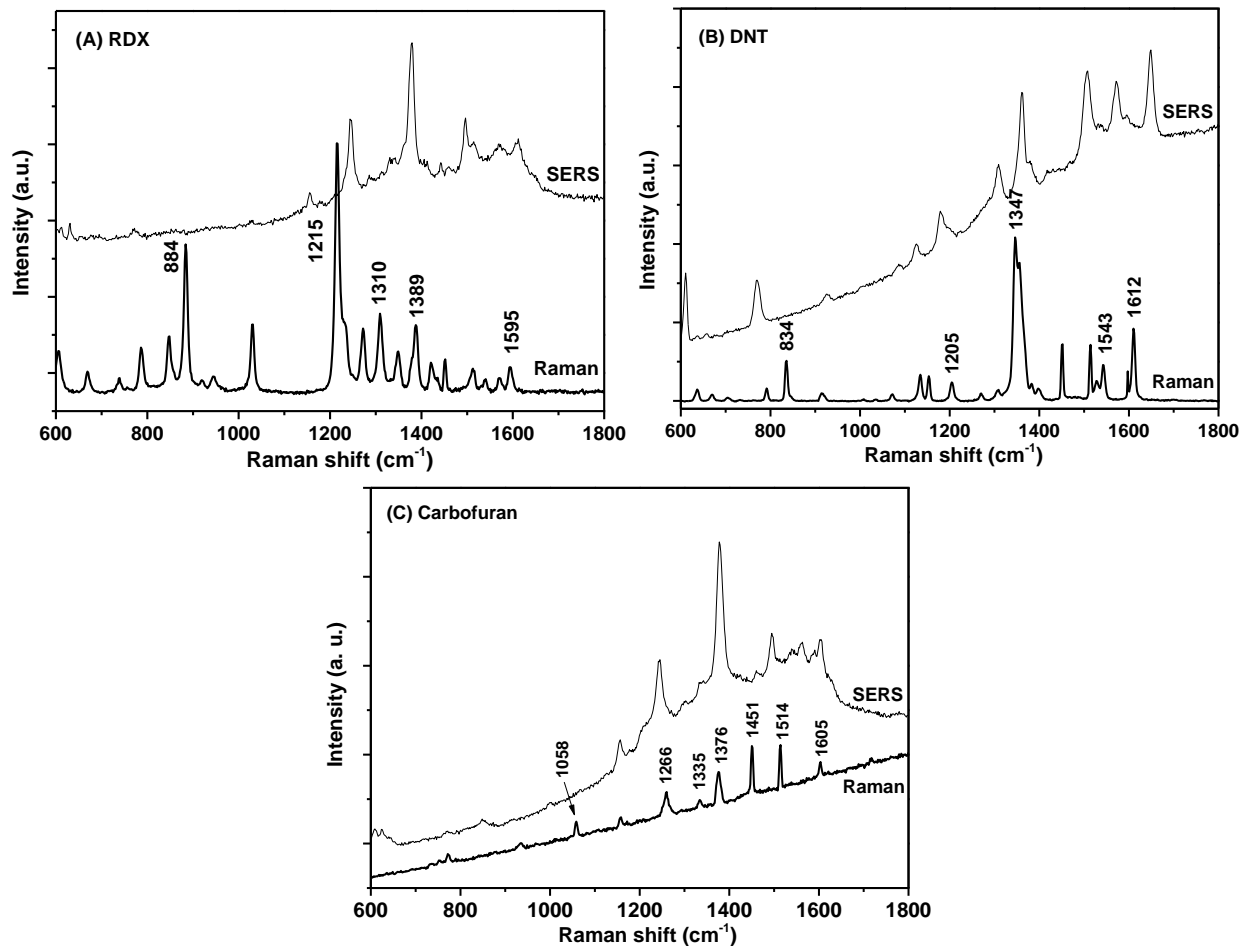
**Figure S5.** Raman spectrum of electrospun polystyrene (PS) mat at a laser power of 5.0% at the sample surface. Laser: 532 nm



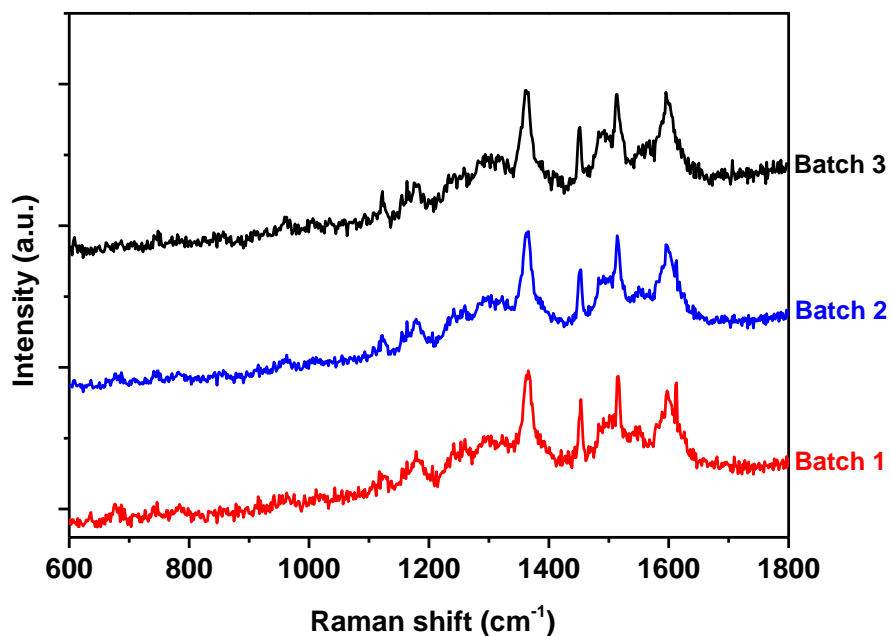
**Figure S6.** (A) Optical image of Rhodamine 6G (concentration was  $10^{-6}$  M) coated PS SERS substrate. (B) Raman spectral image of the marked region of (A). Intensity of  $1647\text{ cm}^{-1}$  peak was plotted. Pink color represents highest intensity.



**Figure S7.** SERS spectrum of Rhodamine 6G taken using polypropylene (PP) as flexible substrate (instead of PS SERS substrate). Substrate is prepared after coating Ag NP onto PP film. The NP coated PP film, slightly wetted using methanol, was used for wiping the analyte from a plastic surface. The analyte, Rhodamine 6G ( $100\text{ }\mu\text{l}$ ,  $10^{-5}$  M) was drop casted on the plastic surface and dried before the wiping step.



**Figure S8.** Comparison of SERS and Raman spectrum of (A) RDX, (B) DNT and (C) Carbofuran. Spectra with thick lines represent Raman spectra collected with 532 nm laser at 5% power. The main peaks in Raman spectra are assigned based on the literature.<sup>1-3</sup> In (A) peaks at 884, 1215, 1310, 1389 and 1595  $\text{cm}^{-1}$  are assigned to ring breathing,  $\text{CH}_2\text{sciss}/\text{N}-\text{N}_{str}$ ,  $\text{CH}_2\text{wagging}$ ,  $\text{NO}_2\text{sym-str}$  and  $\text{NO}_2\text{asym-str}$ , respectively.<sup>1</sup> In (B), peaks at 834, 1205, 1347, 1543 and 1612  $\text{cm}^{-1}$  are assigned to  $(\text{C}-\text{N}_{str})$ , (ring vibration),  $(\text{Ar}-\text{NO}_2\text{sym-str})$ ,  $(\text{Ar}-\text{NO}_2\text{asym-str})$  and ring stretching, respectively.<sup>2</sup> In (C), peaks at 1058, 1266, 1366, 1451 and 1541  $\text{cm}^{-1}$  are assigned to  $\text{ArC}-\text{H}_{bend}$ ,  $\text{CH}_2\text{wagging}$ ,  $\text{CH}_2\text{bending}$  and  $\text{ArC}=\text{C}$ , respectively.<sup>3</sup> Small changes in Raman shift and peaks shapes were observed between the Raman and SERS spectra. Such differences are common and generally arise due to the interaction of analyte with SERS substrate.<sup>3</sup>



**Figure S9.** SERS spectra of RDX taken using different batches of PS-SERS substrates to check the reproducibility of the method. The experiment was done on the same day.

## References

1. N. A. Hatab, G. Eres, P. B. Hatzinger and B. Gu, *Journal of Raman Spectroscopy*, 2010, 41, 1131-1136.
2. A. J. Sedlacek III, S. D. Christesen, T. Chyba and P. Ponsardin, In *Application of UV-Raman spectroscopy to the detection of chemical and biological threats*, Optical Technologies for Industrial, Environmental, and Biological Sensing, International Society for Optics and Photonics, 2004, 23-33.
3. J. Parisi, Q. Dong and Y. Lei, *RSC Advances*, 2015, 5, 14081-14089.