Electronic Supplementary Information

. An Electrical Solid State Sulphur dioxide Vapour Sensor based on Polyvinyl alcohol Formaldehyde Composite

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1. Synthesis of PVFCNPs, PVFCNTs, PVFTH and PVFCY

50 g of PVA was dissolved in deionized water by vigorous stirring with a magnetic stirrer at 95 ^{o}C until completely dissolved. It was then followed by addition of formaldehyde (10 ml) and PEG-100 (1.5 g) into the hot PVA solution with vigorous stirring. 30 mg/ml solution of CNTs was added to the froth followed by addition of 15 ml conc. H_2SO_4 at room temperature. The raw material was oven dried for 5 h. The unreacted materials was removed by washing 5 times with deionized water. The sample so obtained was finally dried for 1 h at 60 ^{o}C.

Similarly, PVFCNTs was prepared by adding an aqueous solution 0.02 g of CNTs. PVFCY and PVFTH were also prepared by slight modification with the addition of 0.1g aqueous solution of cytochrome c and 1 ml thiophene respectively.

2. Thermogravimetric analysis (TGA)

TGA of the synthesized composite materials-PVF, PVFCNTs, PVFCNPs, PVFTH, PVFCY and PVFCOU are carried out. The thermograms suggest that the materials are considerably stable and their complete degradation take place at 600 ^{o}C.

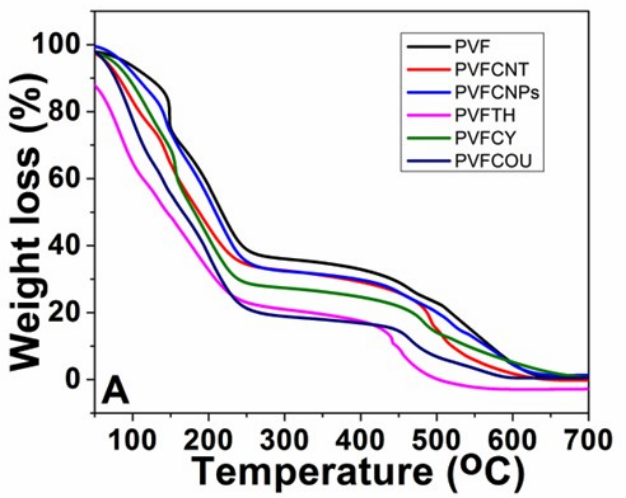

Fig. S1 TGA of the synthesized materials-PVF, PVFCNTs, PVFCNPs, PVFTH, PVFCY and PVFCOU.

3. EDAX analysis of PVFTH/PVFTHSO$_2$ and PVFCOU/PVFCOUSO$_2$

EDAX analysis of PVFTH and PVFCOU are carried out and the EDAX profiles are given below in **Fig. S2.** It is found that S content of SO_2 impregnated PVFTH increases from 4.28 % (PVFTH) to 10.06% (PVFTHSO$_2$) whereas from 0% (PVFCOU) to 4.29% (PVFCOUSO2).

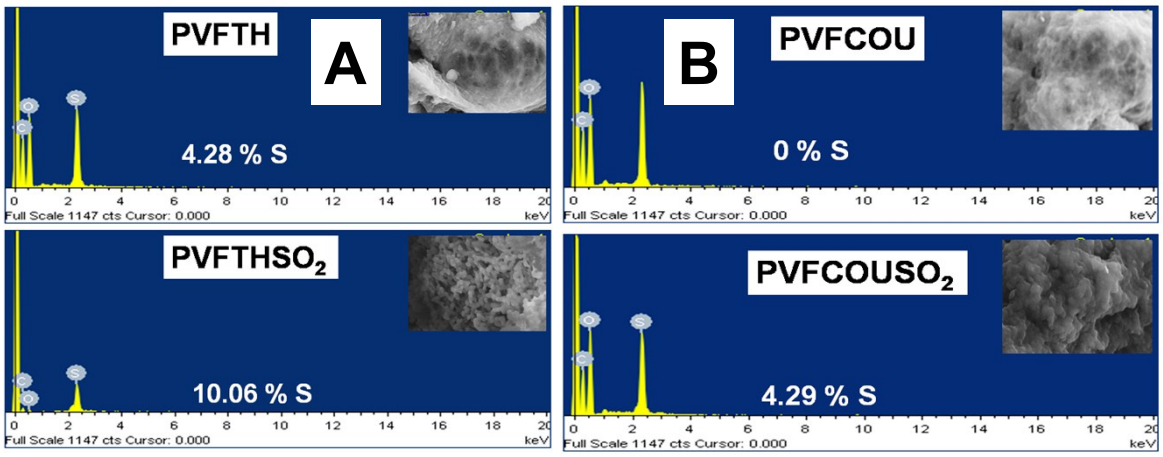

Fig. S2 EDAX profiles of (A) PVFTH and PVFTHSO$_2$; and (B) PVFCOU and PVFCOUSO$_2$

4. FT-IR analysis of PVFCNTsSO_2, PVFCNPsSO_2 and PVFCYSO_2

The FT-IR analysis of PVFCNPs, PVFCNTs and PVFCOU were carried out before and after SO_2 sensing and the plot is depicted below in **Fig. S3.**

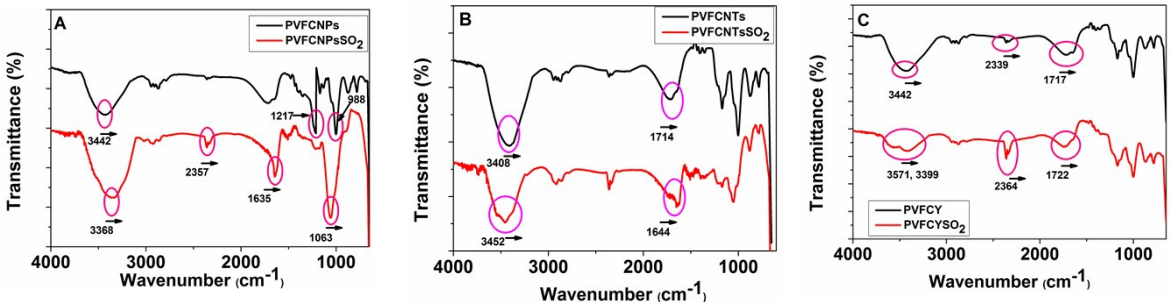

Fig. S3 FT-IR spectra of (A) PVFCNPs and PVFCNPsSO_2; (B) PVFCNTs and PVFCNTsSO_2; and (C) PVFCOU and PVFCOUSO_2

5. Repeatabilitilty and reproducibility studies

Sensing studies are carried out for a consecutive three cycles and it is observed that our sensor exhibit good repeatability and reproducibility (**Fig. S4**). This study indicates that our sensor can be reusable for upto three times.

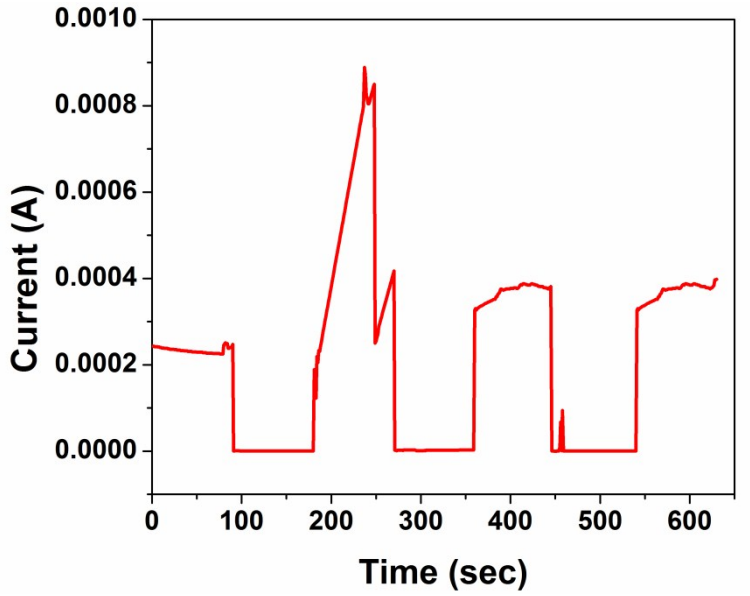

Fig. S4 Repeatability and reproducibility curves for SO_2 sensing by PVFCOU for a consecutive three cycles