Supplementary Information

Synthesis of Perforated Single-Crystalline Mn_2O_3 Microcubes for Thermocatalytic Applications

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1. Materials

Manganese nitrate tetrahydrate ($Mn(NO_3)_2.4H_2O$) was purchased from Sigma Aldrich, and sodium bicarbonate ($NaHCO_3$) was purchased from Merck Life Science Pvt. Ltd., and used without further purification. The AP required for the experiments was synthesized by the reaction between perchloric acid ($HClO_4$) and ammonium hydroxide (NH_4OH), and the obtained crystals were further purified by recrystallization.

2. Characterization of PMOM

Powder X-ray diffraction (P-XRD) analysis was performed at room temperature (25 °C) using a PANalytical X'Pert3 Powder X-ray Diffractometer with Cu Kα radiation (1.54 Å) and step size 0.0263° in the 2θ range of 20 to 70°. The obtained P-XRD patterns were compared with the International Centre for Diffraction Data (ICDD) to confirm the product formation and phase identification. Scanning electron microscopy (SEM) analysis was performed on the synthesized samples using a ZEISS Sigma 300 electron microscope. The SEM images were used to understand the size, morphology, surface, and pore characteristics of the PMOM particles. The particle size was calculated from the SEM images using the ImageJ software. Transmission electron microscopy (TEM) analysis was performed using a JEOL JEM F200 multipurpose electron microscope operated at 200 kV. Brunauer–Emmett–Teller (BET) analysis was employed to determine the surface area, pore diameter, and pore volume of the PMOM samples. The analysis was performed using a Belsorp-max (BEL MicrotracBEL Corp.). equipment for N_2 adsorption at a temperature of 77 K and a saturated vapor pressure of

105.08 kPa. The analysis of the functional groups and component elements contained in the synthesized sample was performed using a PerkinElmer Spectrum Two Fourier Transform Infrared Spectrometer with UATR accessory. The values were recorded in the infrared region of 4000 – 400 cm^{-1}. Raman spectra were collected with an excitation wavelength of 532 nm using a LabRAM HR Evolution (Horiba Scientific) confocal Raman microscope.

3. Thermal analysis data of $MnCO_3$ precursor

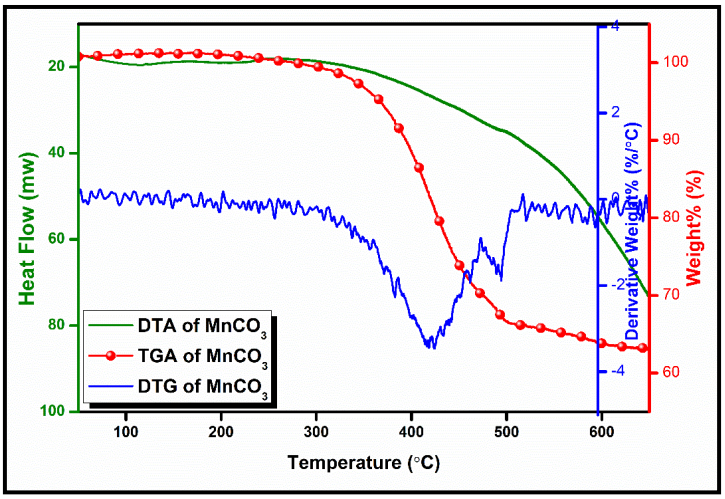

Fig. S1 TGA curve of $MnCO_3$ precursor

4. BET analysis data

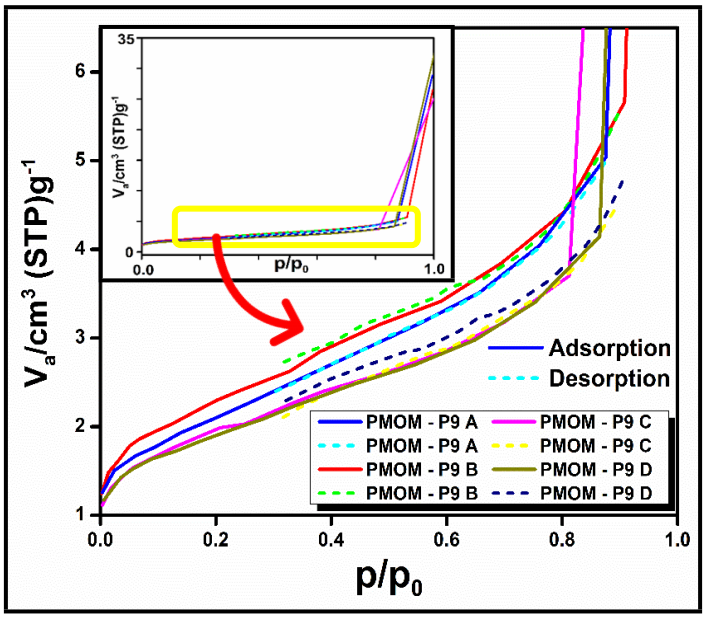

Fig. S2 BET adsorption-desorption isotherm of all the synthesized PMOM samples (inset shows the full adsorption-desorption isotherm plot)

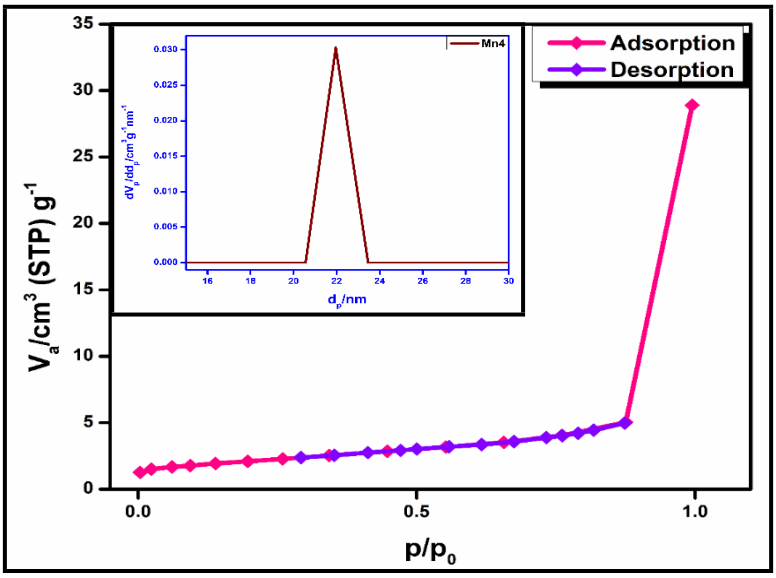

Fig. S3 BET adsorption−desorption isotherm of PMOM – P8 A (the pore size distribution is shown as inset)

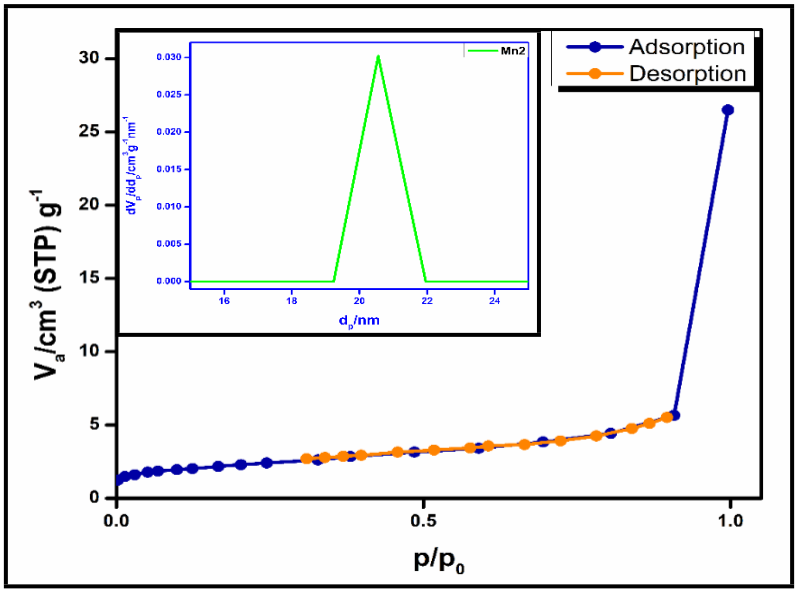

Fig. S4 BET adsorption−desorption isotherm of PMOM – P9 B (the pore size distribution is shown as inset)

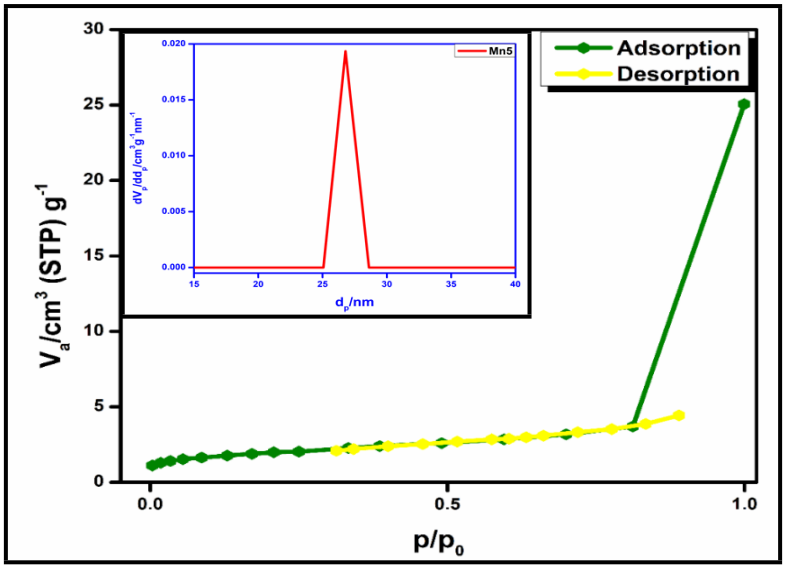

Fig. S5 BET adsorption−desorption isotherm of PMOM – P8 C (the pore size distribution is shown as inset)

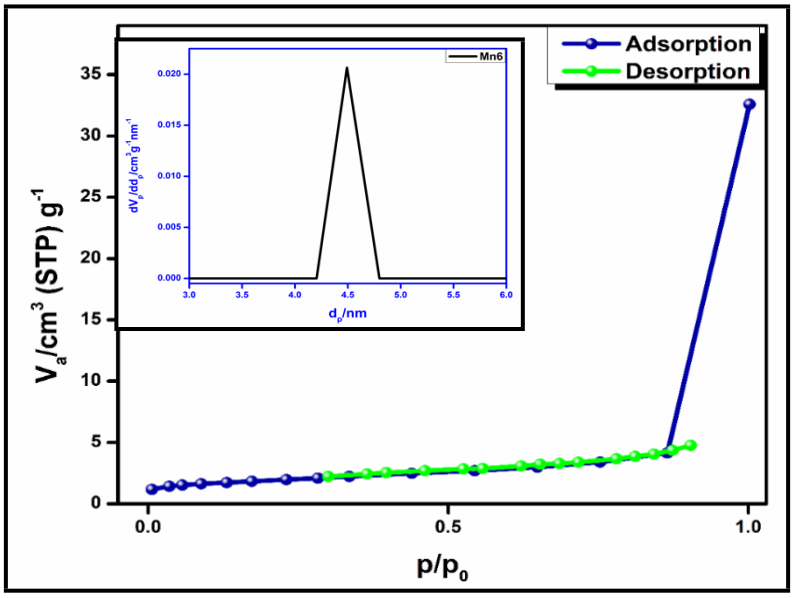

Fig. S6 BET adsorption−desorption isotherm of PMOM – P9 D the pore size distribution is shown as inset)

5. FTIR analysis data

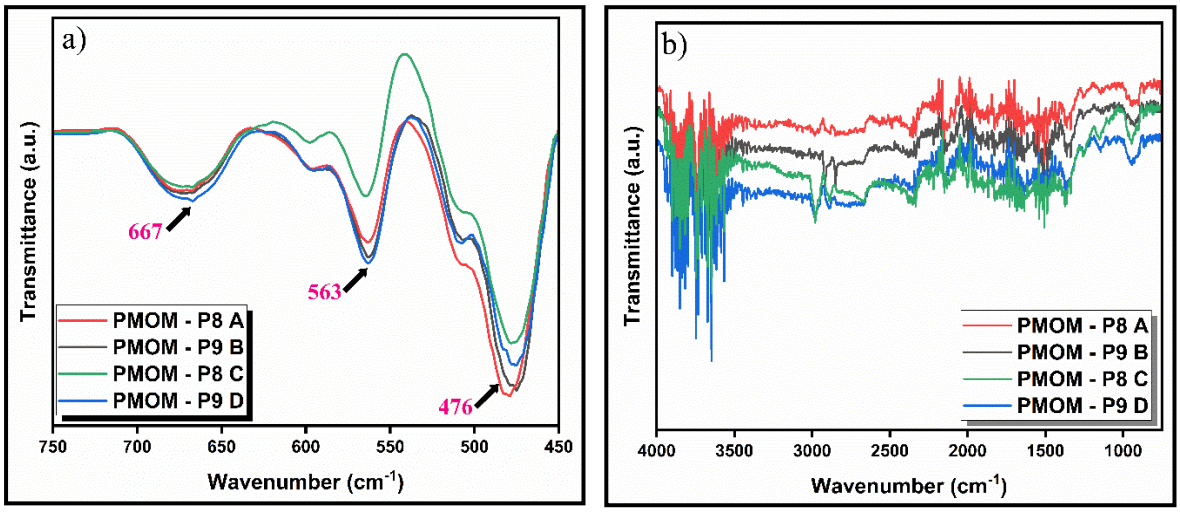

Fig. S7 FTIR spectra of PMOM samples

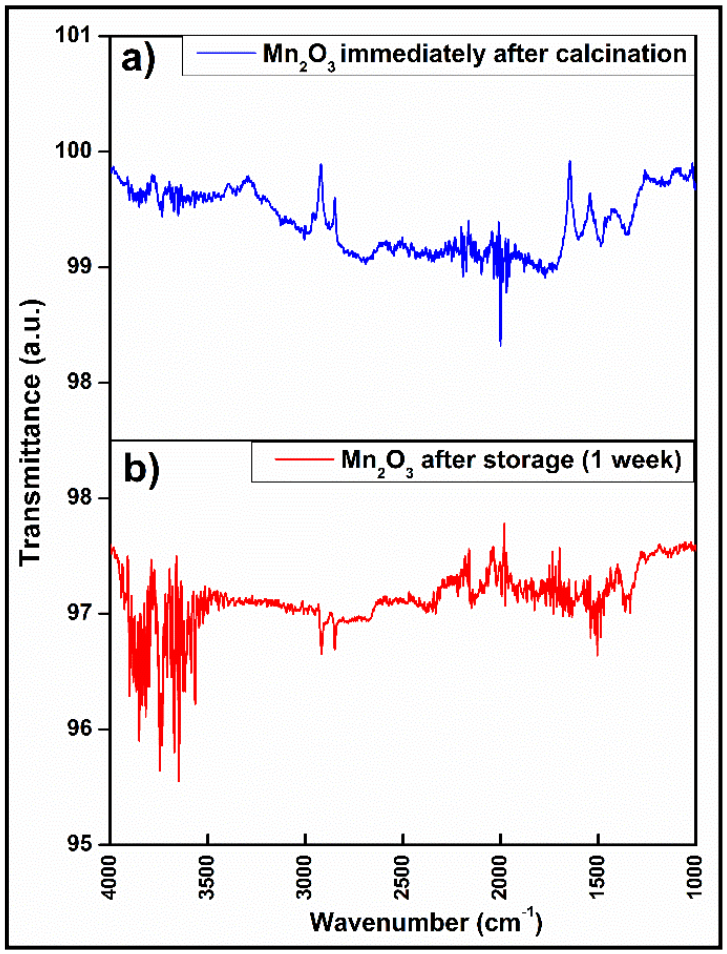

Fig. S8 FTIR spectra of PMOM samples recorded a) immediately after calcination and b) after storage (1 week)

6. Raman spectra of PMOM samples

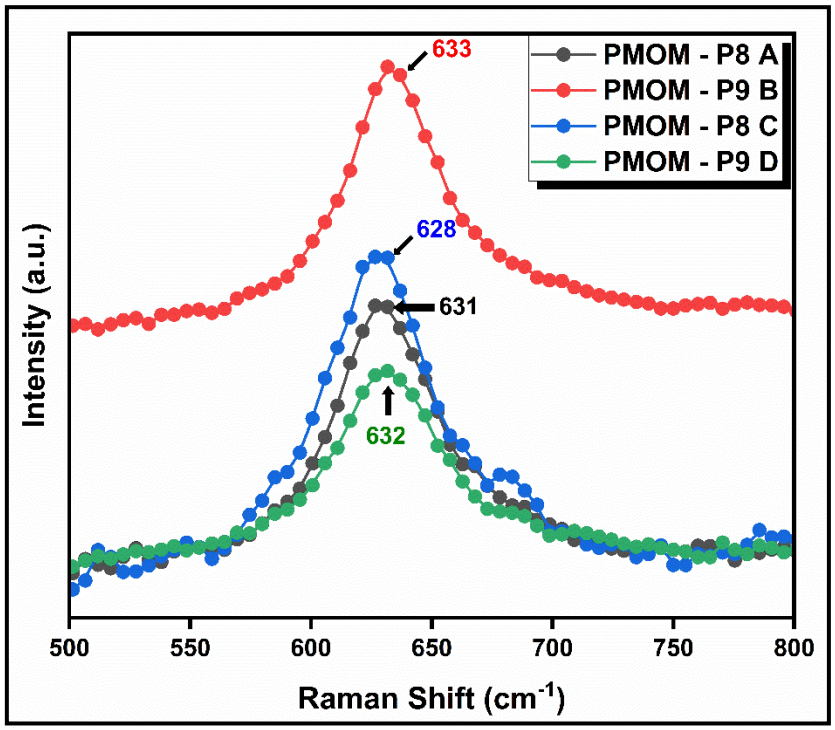

Fig. S9 Raman spectra of PMOM samples

7. Thermal analysis data of AP

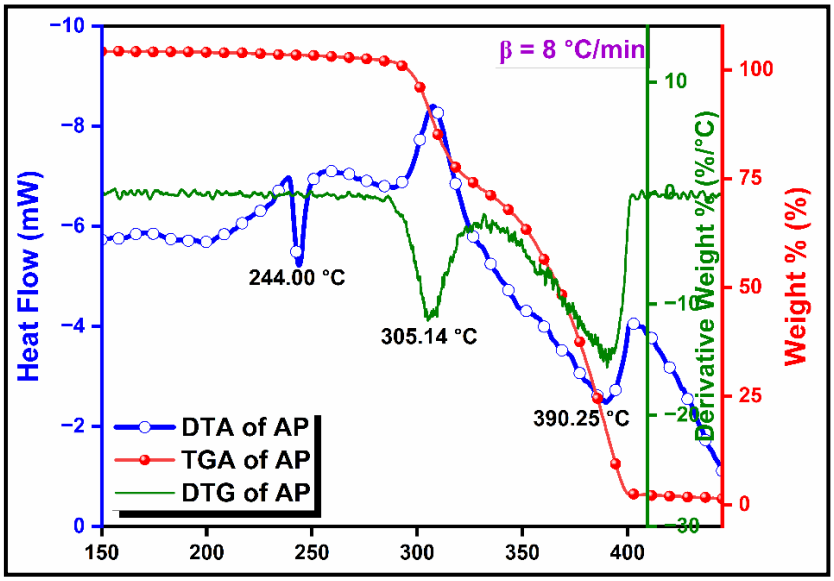

Fig. S10 TG-DTA plot of pure AP

8. SEM images of PMOM samples

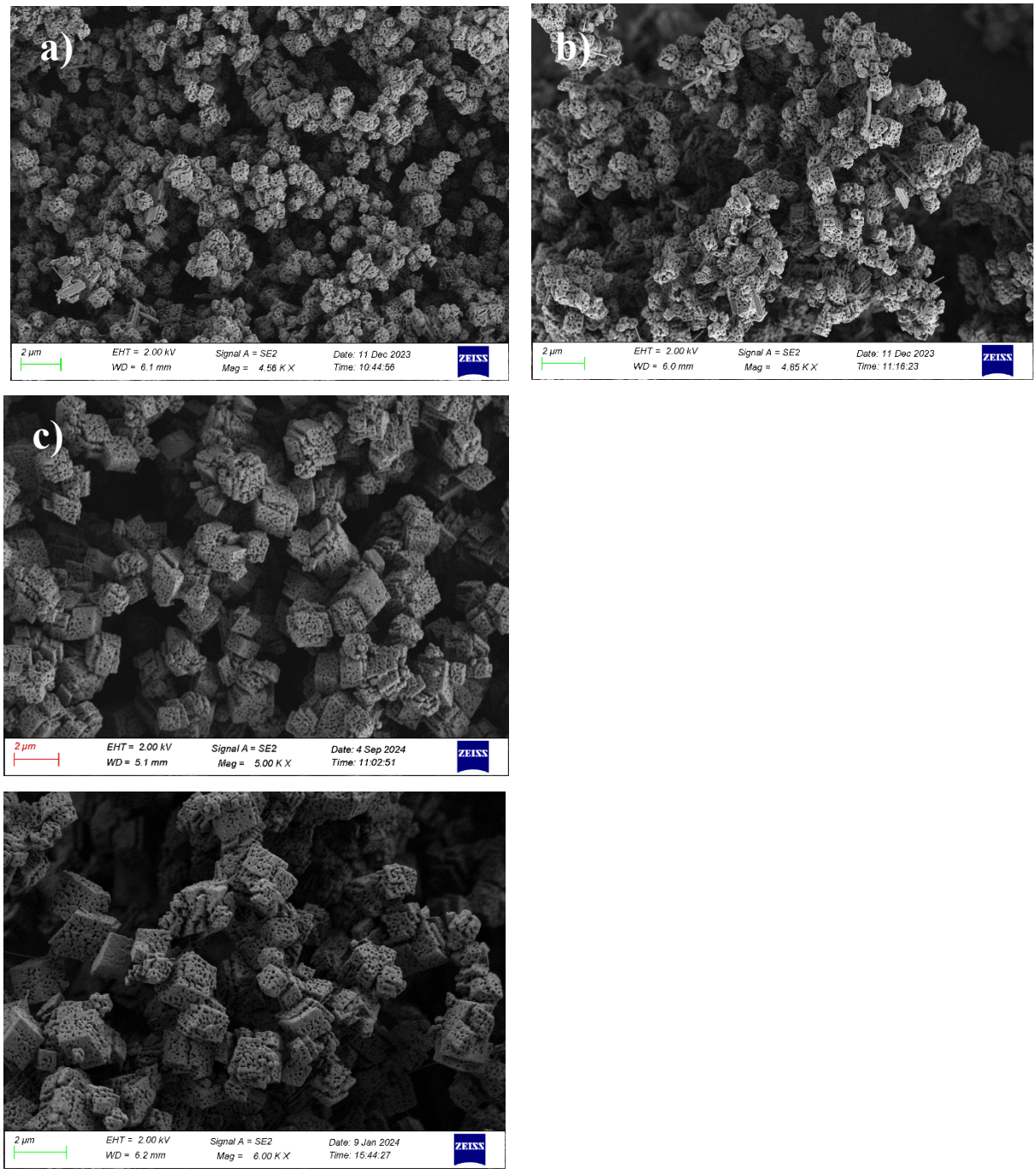

Fig. S11 SEM image of a) PMOM – P8 A b) PMOM – P9 B c) PMOM – P8 C d) PMOM – P9 D