

## Supporting Information

### **Laser-Driven Rapid Synthesis of Metal Organic Frameworks, Quantum Chemical Analysis and Investigation of UV-NIR Optical Absorption, Luminescence, Photocatalytic Degradation, and Gas and Ion Adsorption Properties**

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## **Supplemental experimental procedures**

### **S.1. Experimental Section**

#### **S.1.1. Synthesis of Lg-Based MOF (bpeMOF)**

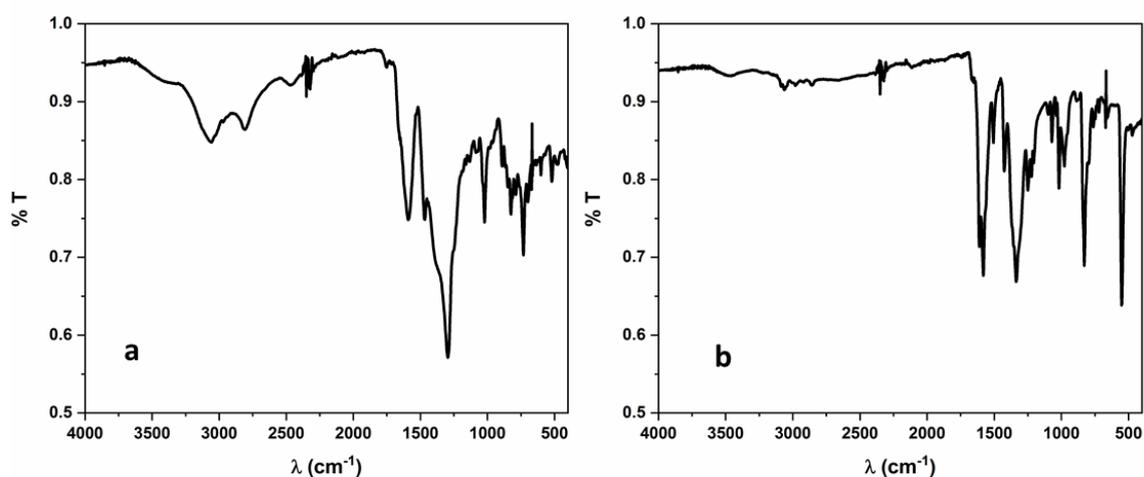
Zn(NO<sub>3</sub>).H<sub>2</sub>O and 1,2-bis(4-pyridyl) ethane (bpe) (14.04 mg, 0.066 mmol) were mixed in solvents [DMF/H<sub>2</sub>O = 1:1 (v/v)]. The resulting solution was stirred for 5 minutes. Whitish in color bpeMOF crystals was synthesized in 70 minutes using a laser beam source at 88-90°C.

### S.1.2. Synthesis of H<sub>2</sub>L Based MOF (H<sub>2</sub>LMOF)

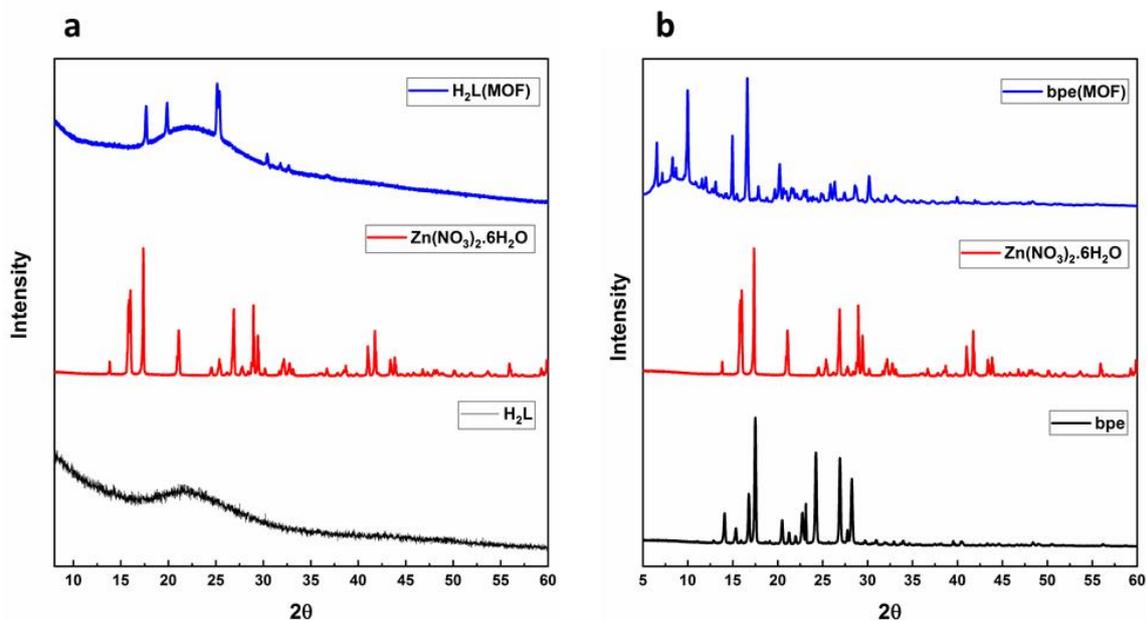
Zn(NO<sub>3</sub>)<sub>2</sub>·6H<sub>2</sub>O (10 mg, 0.033 mmol) and H<sub>2</sub>L (11.46 mg, 0.033 mmol) were mixed in solvents [DMF/H<sub>2</sub>O = 1:1 (v/v)]. The resulting solution was stirred for 5 minutes. Yellow colored H<sub>2</sub>LMOF crystals was synthesized in 70 minutes using a laser beam source at 88-90°C

## S.2. Material Characterization of Laser-Driven bpe(MOF) and H<sub>2</sub>L(MOF)

### 2.1. Structure Characterization

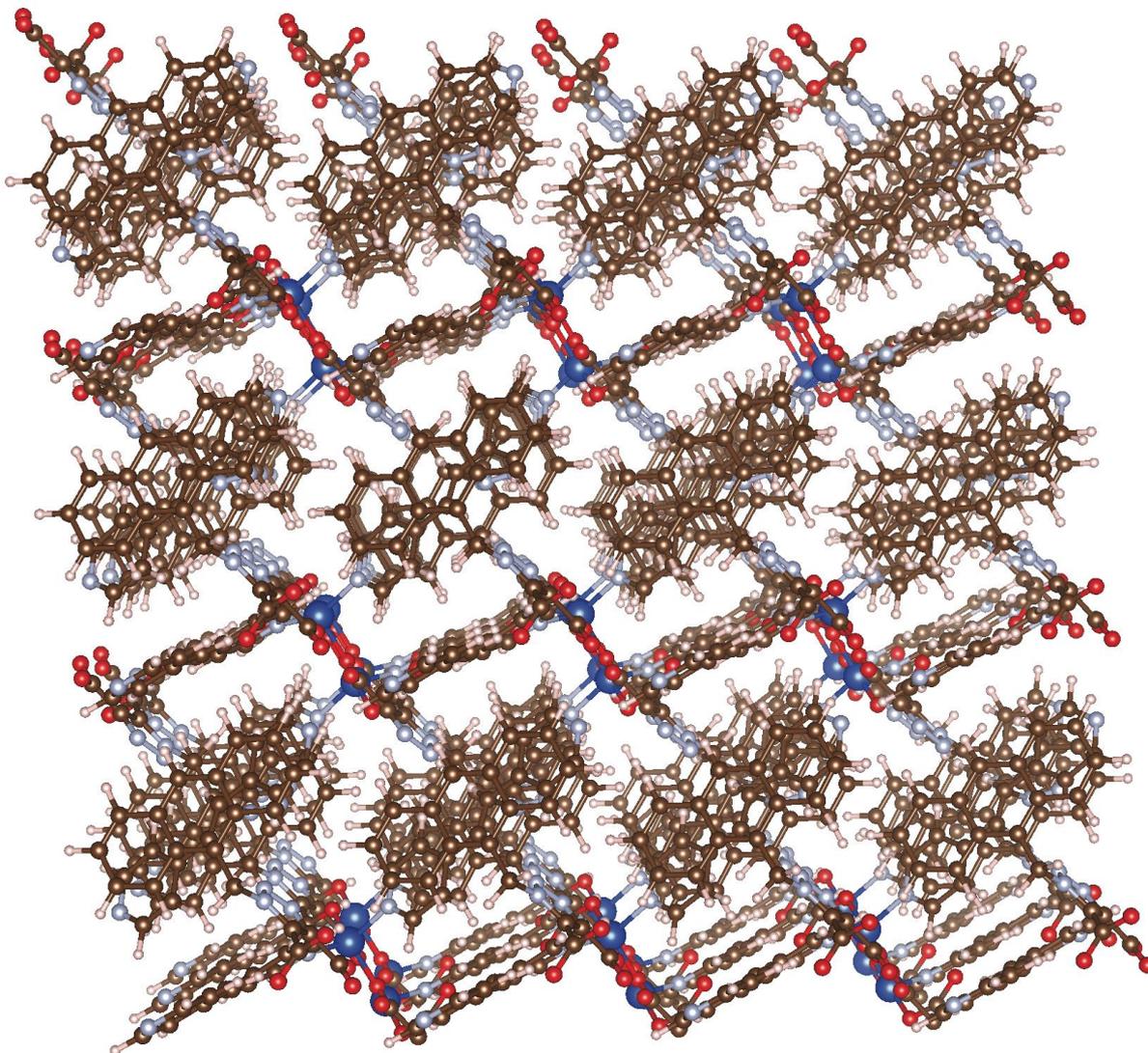


**Figure S1.** FTIR spectrum of H<sub>2</sub>L(MOF) (a) and bpe(MOF) (b)



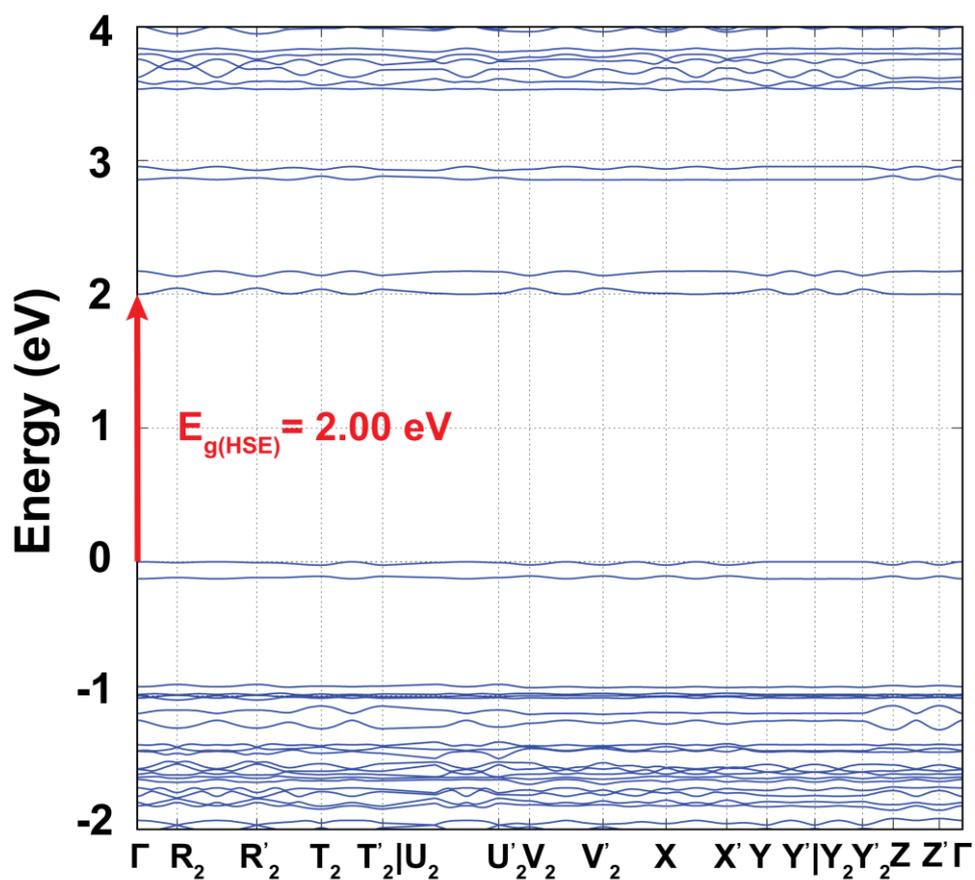
**Figure S2.** XRD spectrum of zinc salt, a H<sub>2</sub>L and H<sub>2</sub>L(MOF) structures (a) XRD spectrum of zinc salt, bpe and bpe(MOF) (b)

It is seen that the crystal structure formation is more in bpe(MOF), while the amorphous structure of H<sub>2</sub>L(MOF) is exhibited.

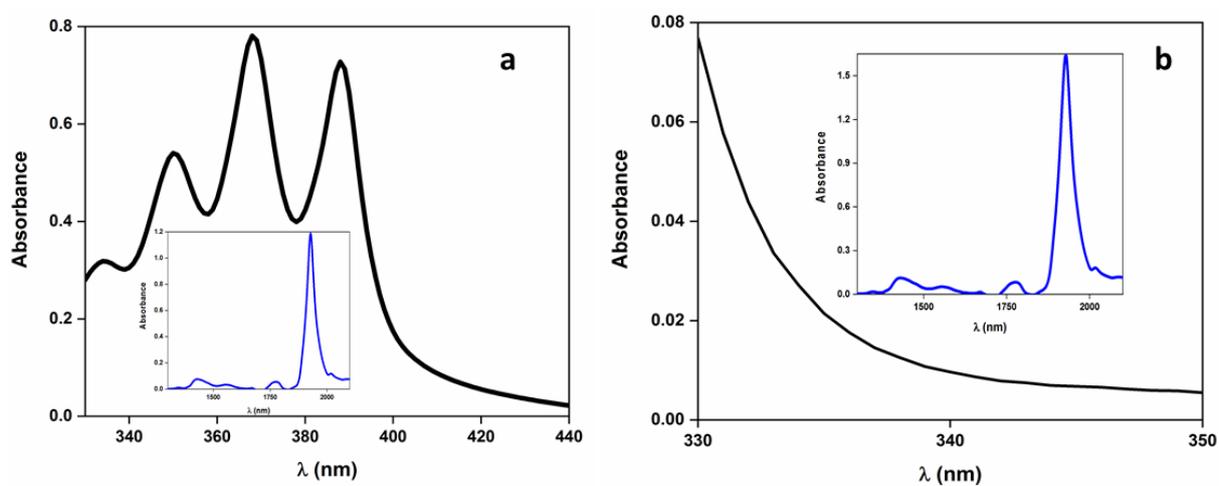


**Figure S3:** The 3D crystalline structure of ZnMOF. The dark blue, light blue, red, brown, and white spheres represent Zn, N, O, C, and H atoms respectively.

## 2.2. Photophysical Properties

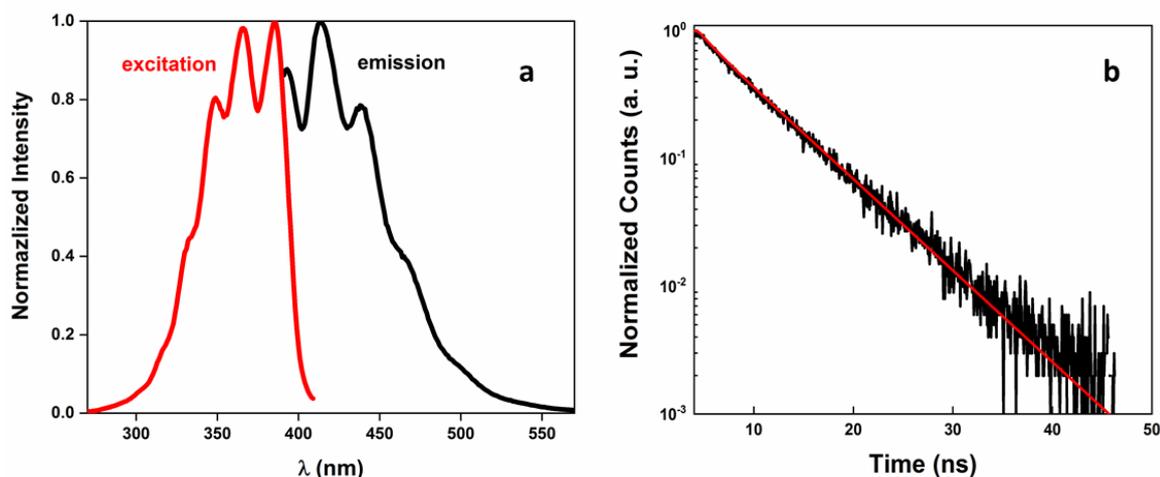


**Figure S4.** The electronic band structure of ZnMOF along all symmetry directions



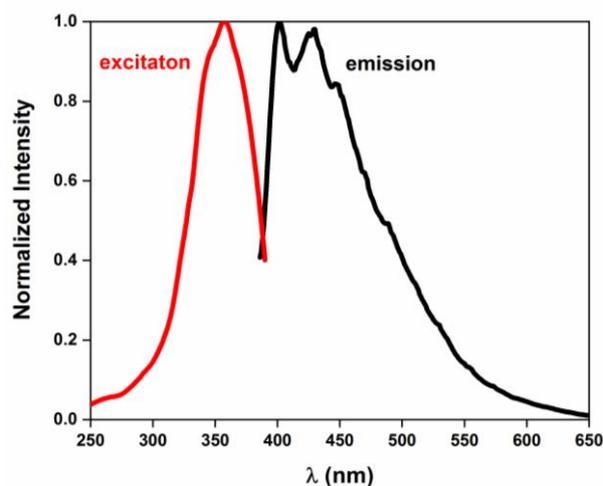
**Figure S5.** UV-Vis-NIR absorption spectrum in DMF (1mg/3ml)  $\text{H}_2\text{L}(\text{MOF})$  (a) and  $\text{bpe}(\text{MOF})$  (b)

In Figure S5B, while there are no absorption peaks in the Uv-vis region of BPE(MOF), the presence of absorption peaks belonging to both MOF structures in the NIR region is seen.



**Figure S6.** Fluorescence excitation ( $\lambda_{\text{obs}}$  413 nm) and emission ( $\lambda_{\text{exc}}$  366 nm) spectrum of H<sub>2</sub>L (MOF) in ethanol at room temperature **(a)**. Time-resolved emission decay curves of H<sub>2</sub>L (MOF) at 413 nm under ambient conditions, where the red line indicates the fitting curves and the black line indicates the experimental data **(b)**.

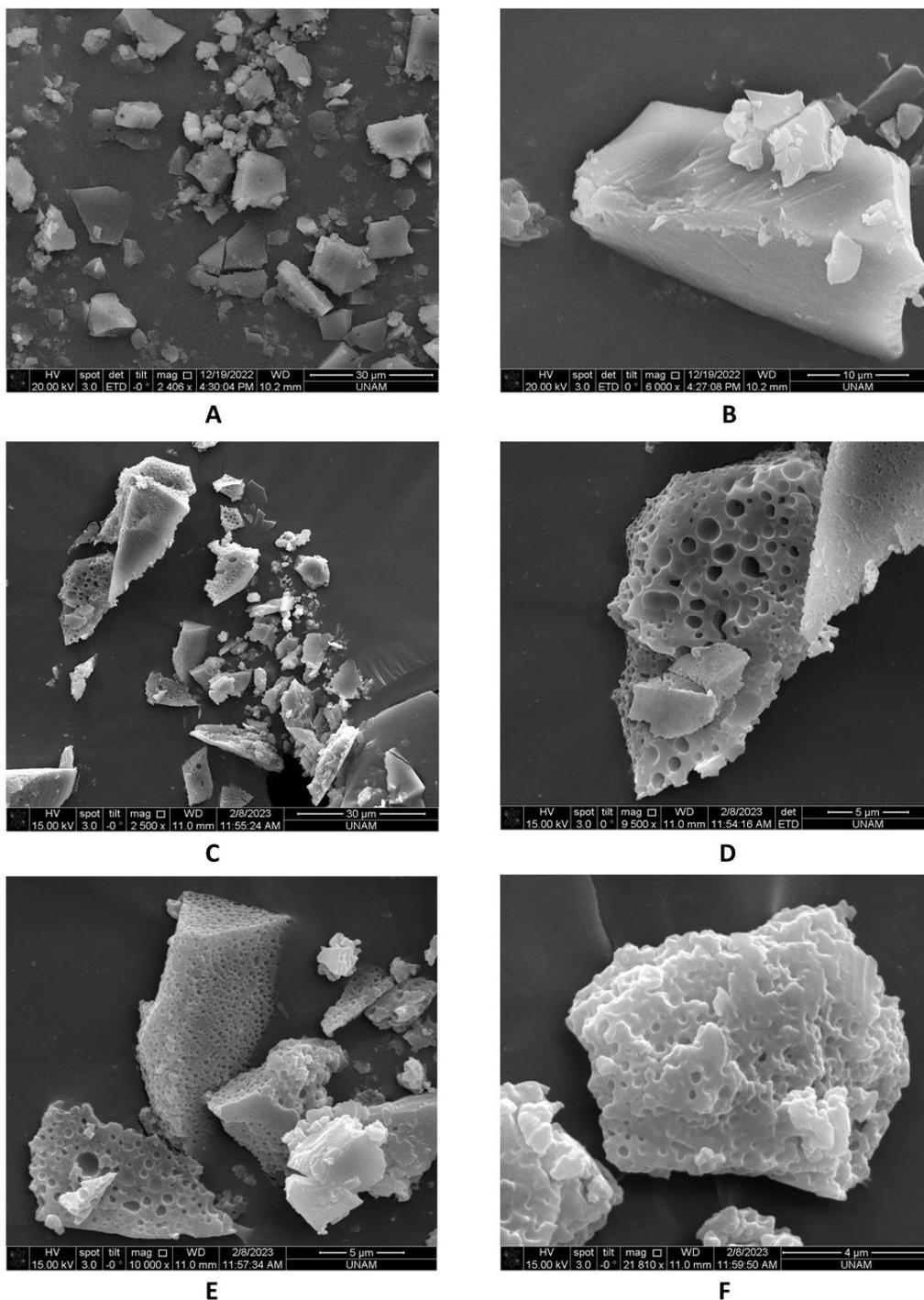
The singlet excited state energy of H<sub>2</sub>L(MOF) was estimated 306.7 kJ mol<sup>-1</sup>. Fluorescence quantum yield measurement was performed by using of 9,10-diphenylanthracene ( $\phi_f = 0.95$  in ethanol) as standard and  $\phi_f$  was found to be 63.0%. It also has fluorescence lifetimes of 1.4 and 6.0 ns.



**Figure S7.** Fluorescence excitation ( $\lambda_{\text{abs}}$  355 nm) and emission ( $\lambda_{\text{exc}}$  398 nm) spectrum of bpe(MOF) in ethanol at room temperature

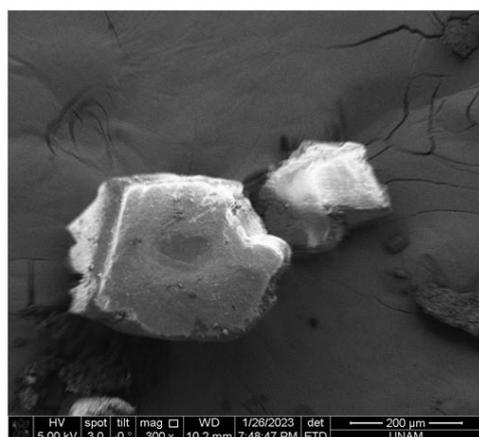
The singlet excited state energy of bpe(MOF) was estimated  $309.11 \text{ kJ mol}^{-1}$ . The ligand, which does not have photoluminescent chromophore groups, has no fluorescence quantum efficiency and lifetime of the metal organic framework structure.

### 2.3. Morphological Characterization

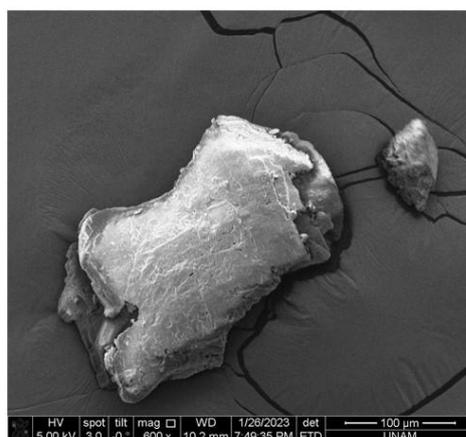


**Figure S8.** SEM images of H<sub>2</sub>L (A,B) and H<sub>2</sub>L(MOF) at 70 min (C-F)

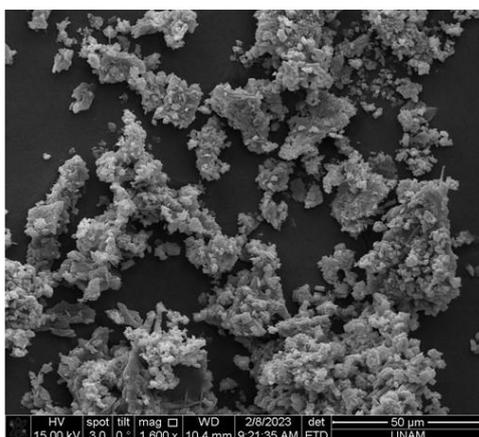
When the SEM images of H<sub>2</sub>L(MOF) are examined, it is seen that the perforated structures with layers are formed.



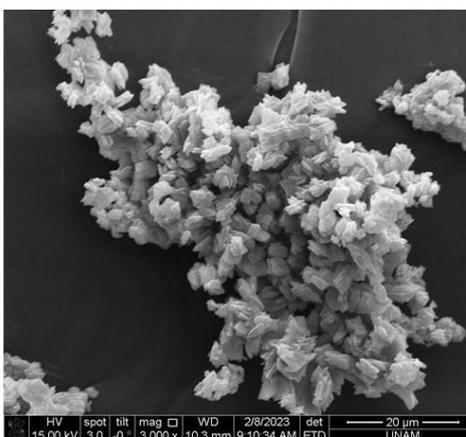
**A**



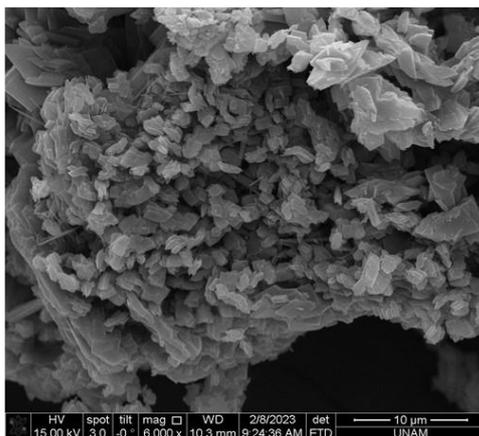
**B**



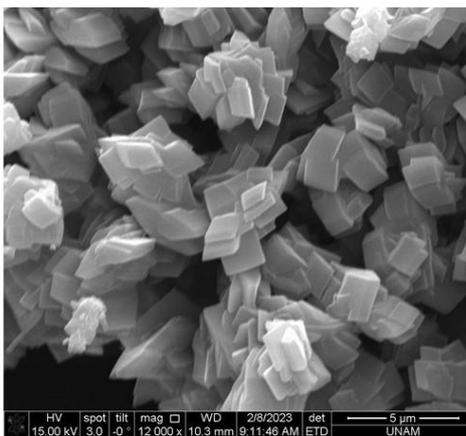
**C**



**D**



**E**



**F**

**Figure S9.** SEM images of bpe (A,B) and bpe(MOF) at 70 min (C-F)