

Supporting Information

Particle Size Dependence of Proton Conduction in a Cationic Lanthanum Phosphonate MOF.

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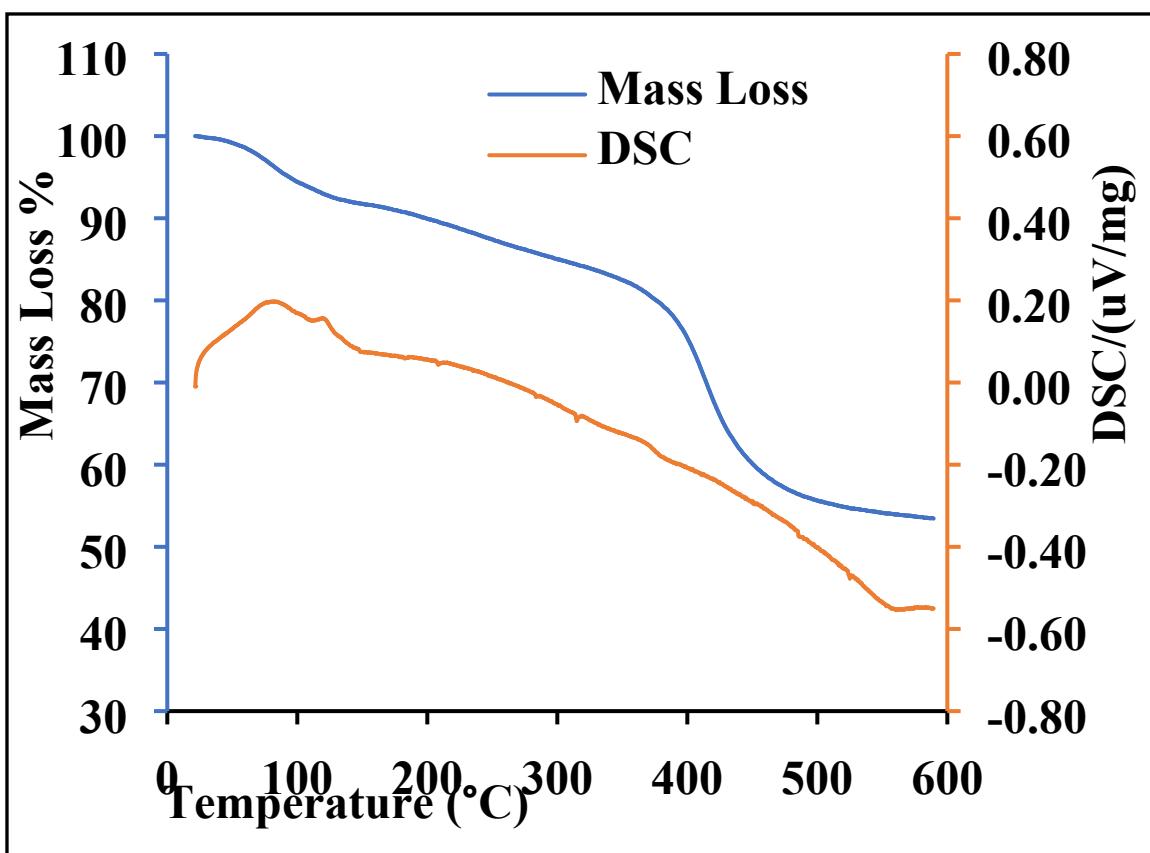


Figure S1. Thermogravimetric Analysis of PCMOF21-AcO as Synthesized.

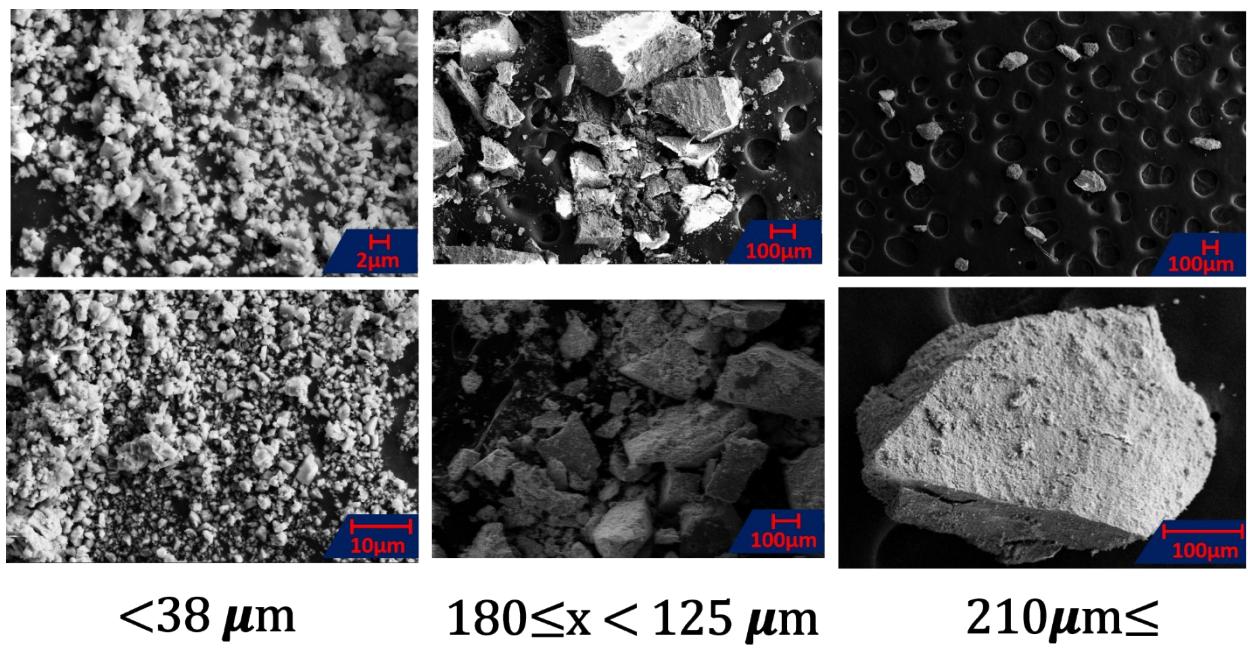


Figure S2. Post Impedance SEM Analysis of Particles from the Analyzed Distributions

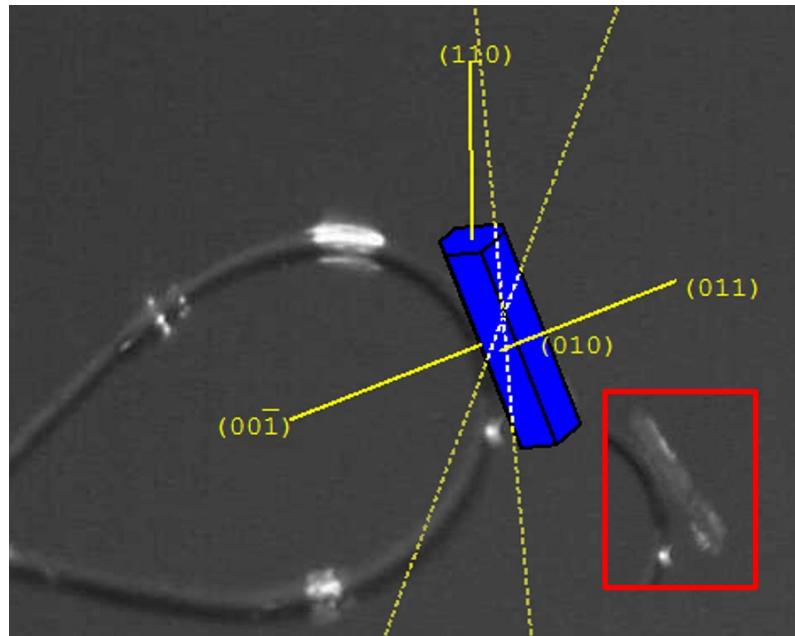


Figure S3. Indexed Single Crystal of PCMOF21-AcO

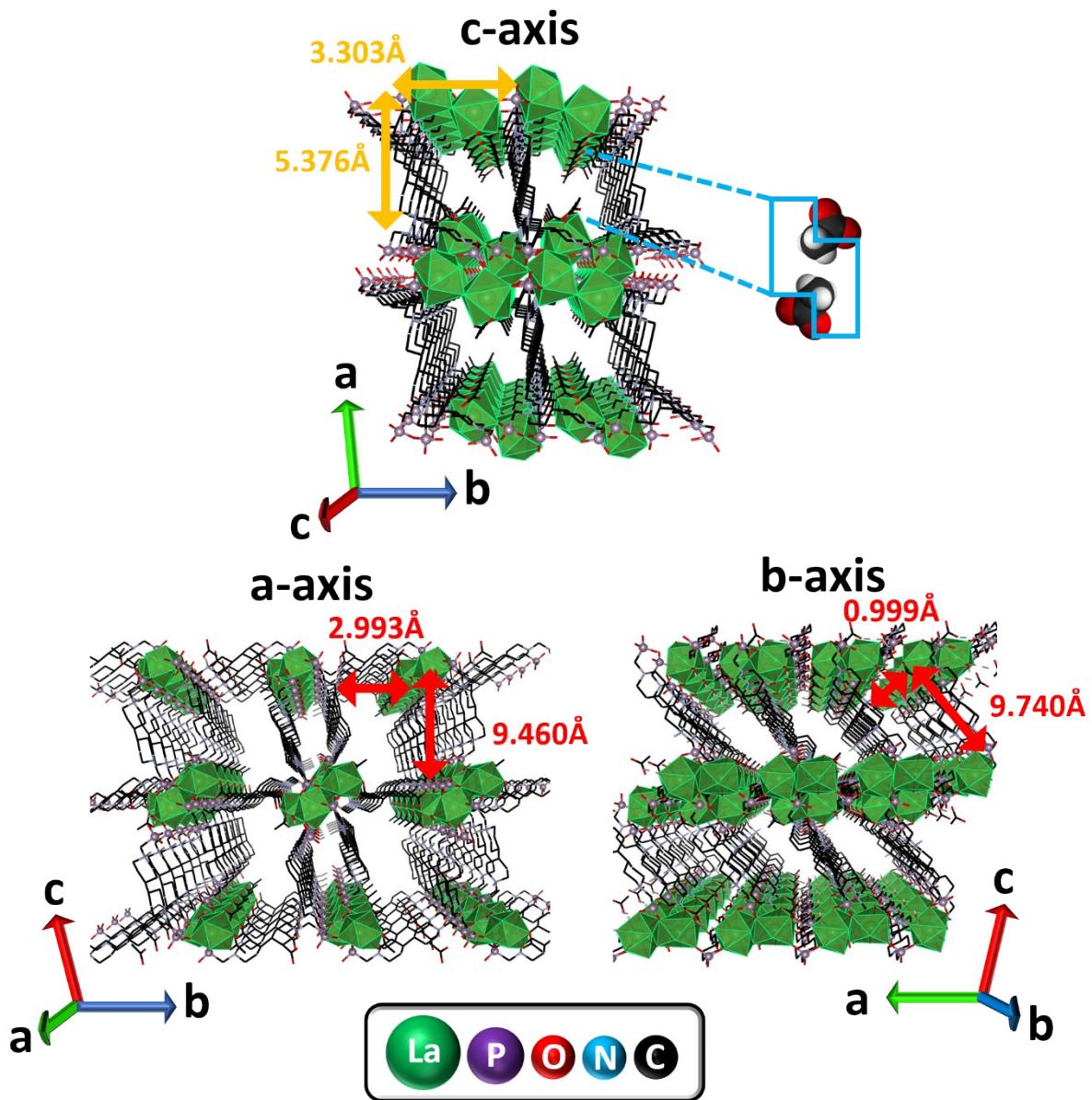


Figure S4. Crystal structure of PCMOF21-AcO obtained at 100K.

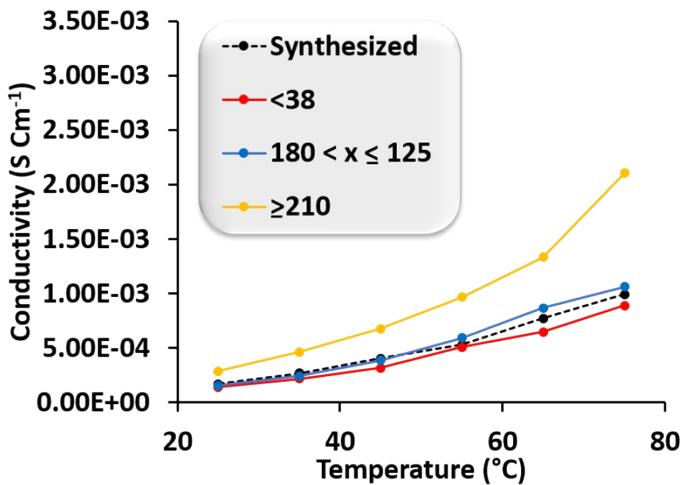


Figure S5. Conductivity versus Temperature Comparison of Various Particle Sizes

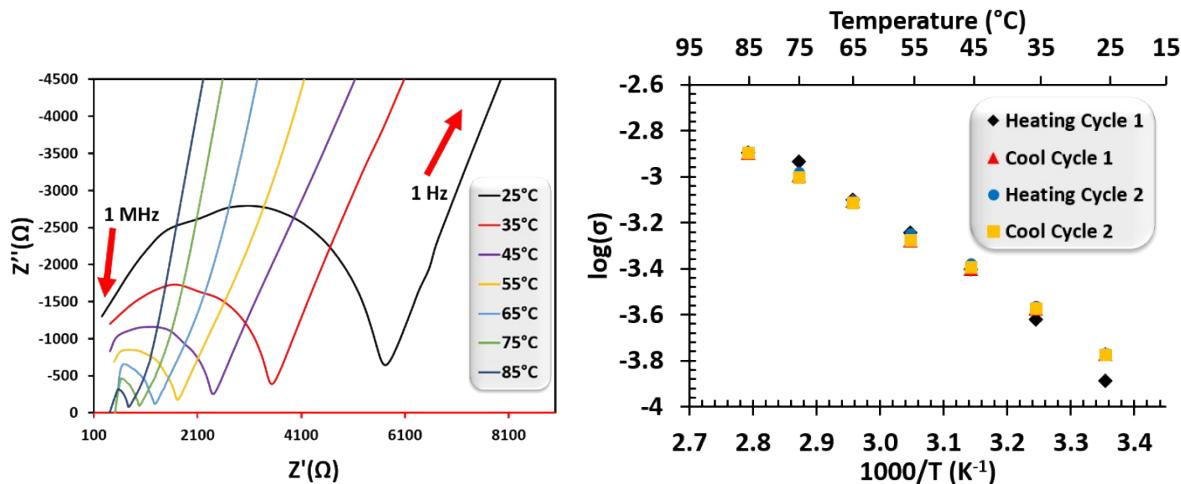


Figure S6. Nyquist (Left) Second Cooling Cycle and Arrhenius Plots (Right) for 'As Synthesized' Sample

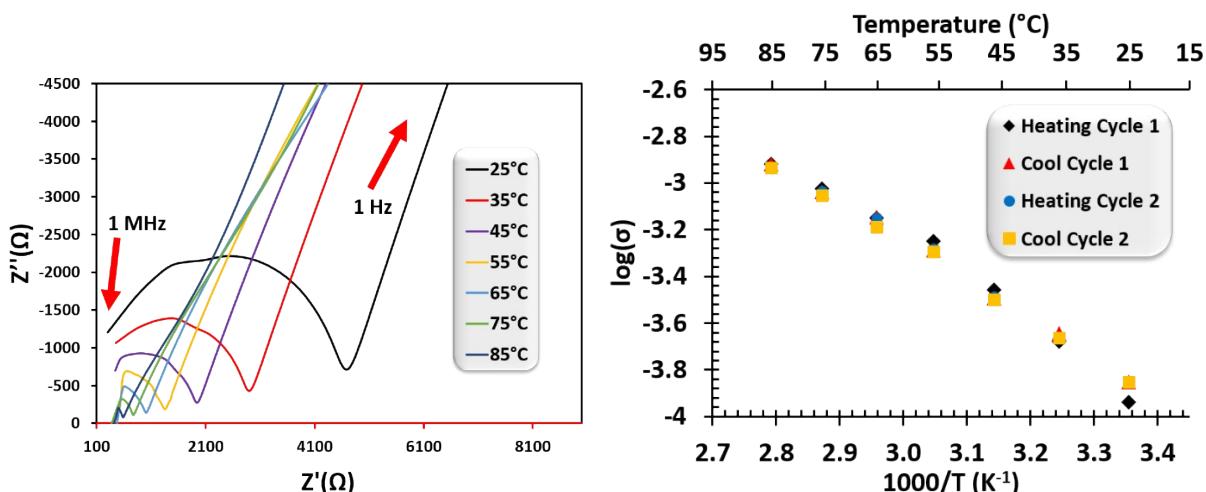


Figure S7. Nyquist (Left) Second Cooling Cycle and Arrhenius Plots (Right) for $<38\mu\text{m}$ Particle Size

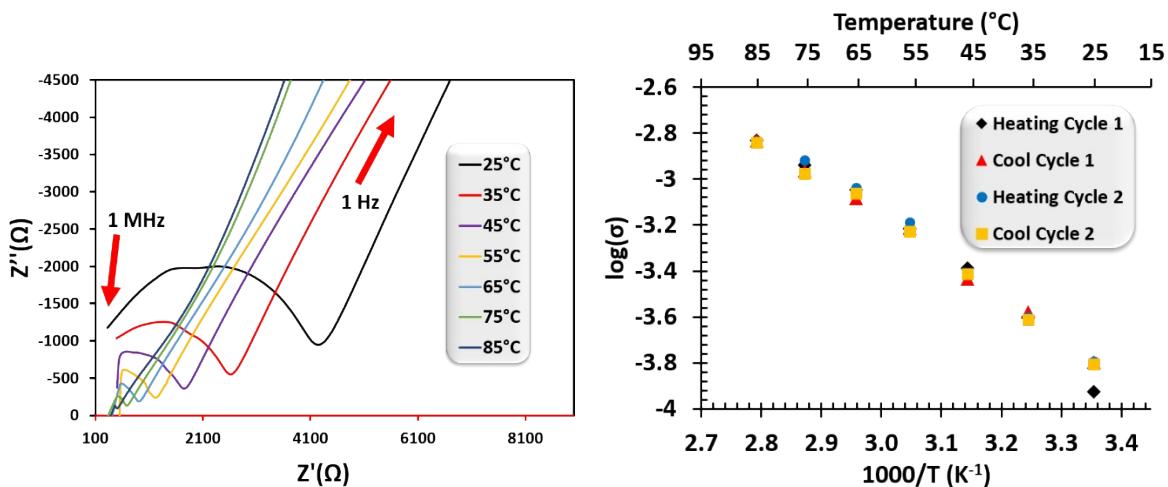


Figure S8. Nyquist (Left, Second Cooling Cycle) and Arrhenius Plots (Right) for $180 > x \geq 125 \mu\text{m}$ Particle Size

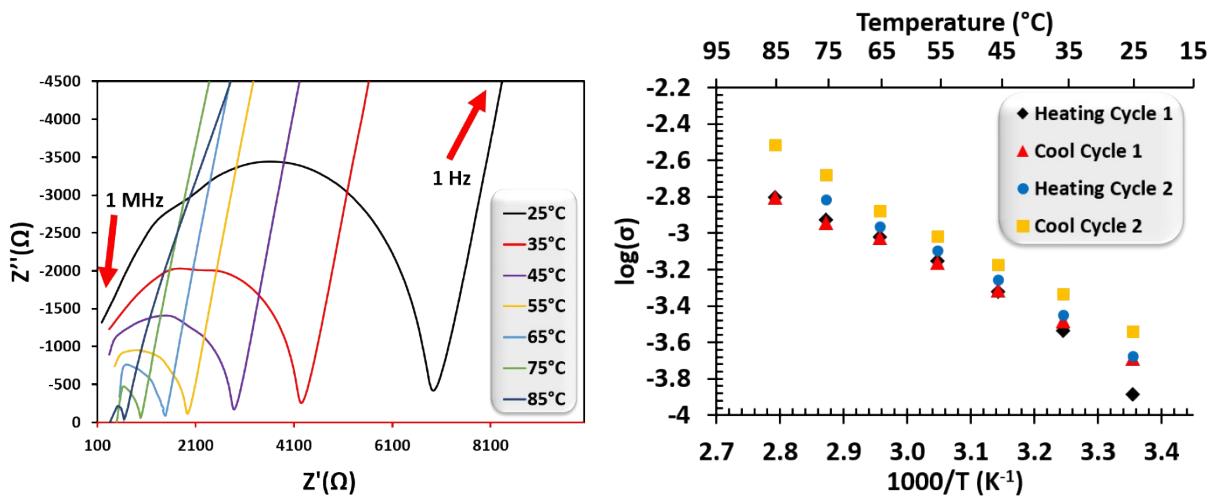


Figure S9. Nyquist (Left, Second Cooling Cycle) and Arrhenius Plots (Right) for $\geq 210 \mu\text{m}$ Particle Size

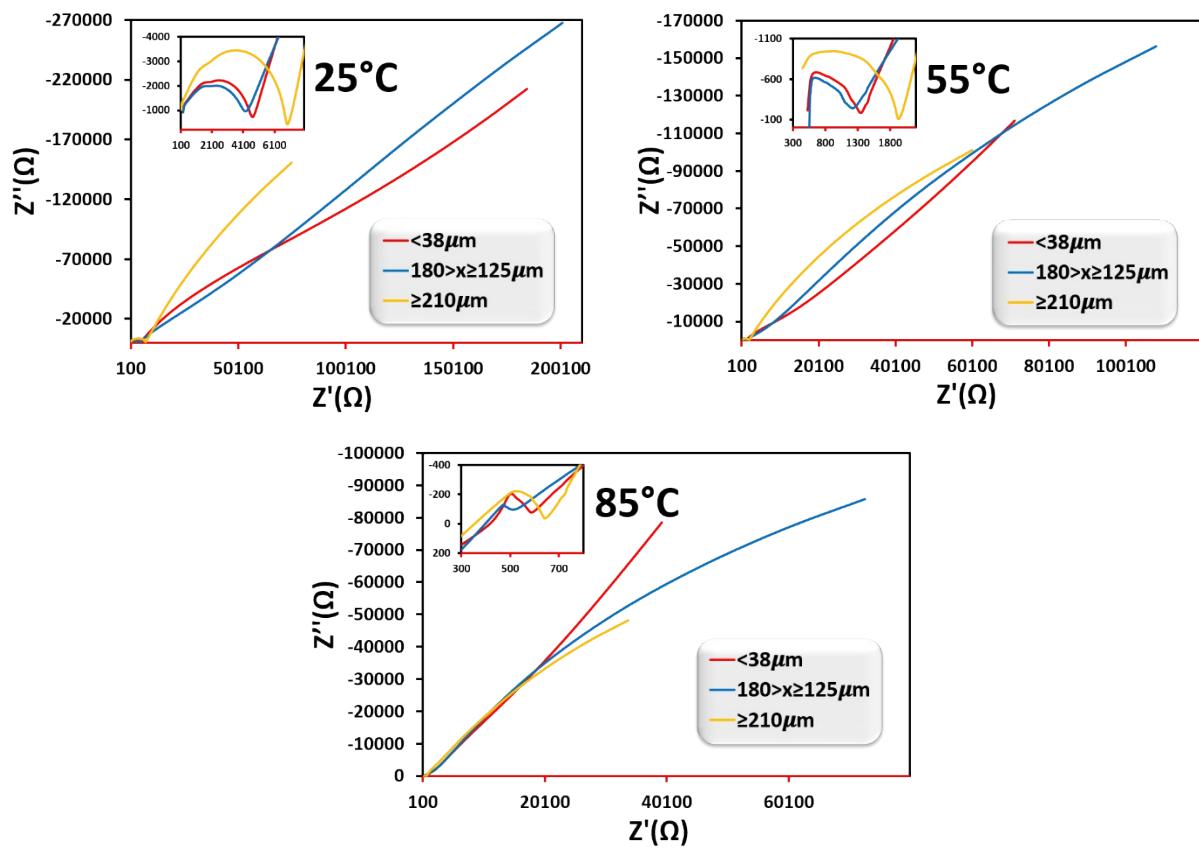


Figure S10. Extended Nyquist plots comparison of the particle sizes at various temperature ranges

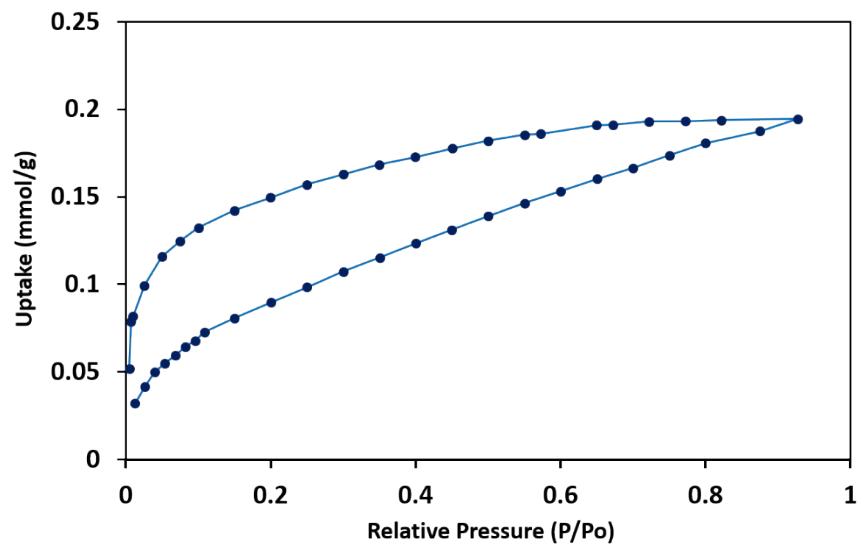


Figure S11. 195K CO₂ Absorption data activated at 100°C overnight for PCMOF21-AcO

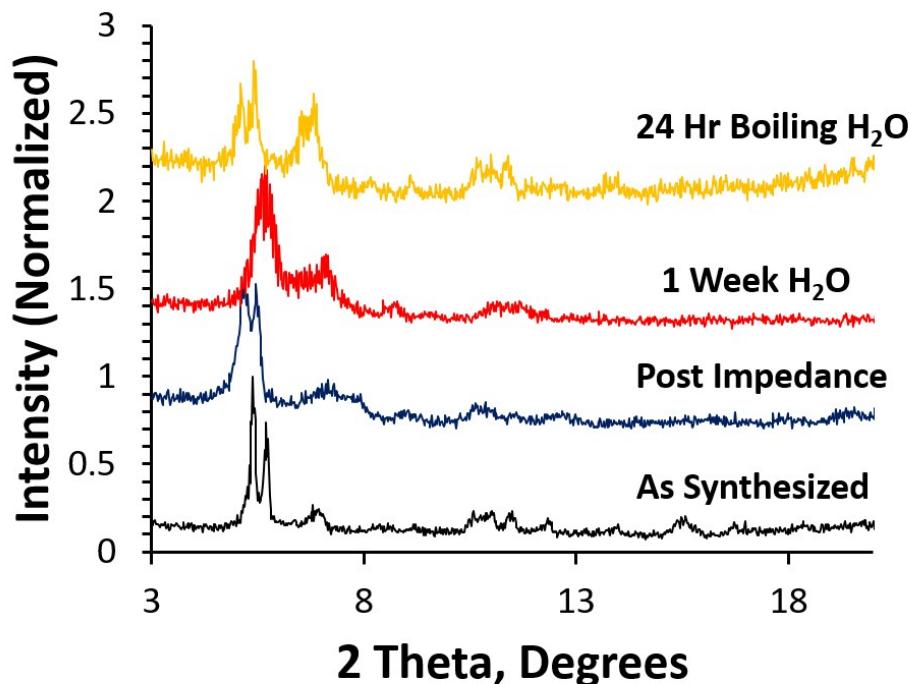


Figure S12. PXRD Pattern of PCMOF21-AcO Subject to Different Aqueous Conditions

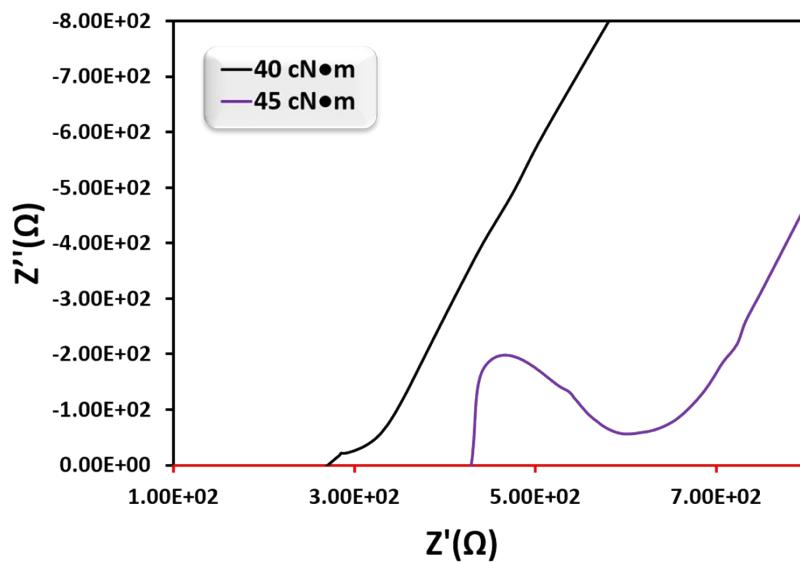


Figure S13. Nyquist Plot Comparison of the 40 & 45 cN•m Variable Torque Experiment.

| MOF | PCMOF21-AcO |
|---|---|
| Empirical formula | C ₂₂ H ₄₆ La ₂ N ₃ O ₁₅ P ₃ |
| FW (g mol ⁻¹) | 963.35 |
| Space group | P-1 |
| λ (Å) | 0.71073 |
| Collection temp (K) | 100 |
| a (Å) | 9.6056(16) |
| b (Å) | 15.424(3) |
| c (Å) | 16.780(3) |
| α (deg) | 95.434(7) |
| β (deg) | 106.266(7) |
| γ (deg) | 91.765(9) |
| V (Å ³) | 2371.5(7) |
| Crystal size (mm) | 0.308 x 0.157 x 0.084 |
| Z | 2 |
| ρ _{calc} (g cm ⁻³) | 1.349 |
| 2θ range (deg) | 5.174 to 56.886 |
| Data/restraints/parameters | 11739/0/410 |
| No. reflns | 32249 |
| Ind reflns [I > 2σ(I)] | 11739 |
| GOF, F ² | 0.968 |
| R factor [I > 2σ(I)] | R ₁ = 0.0494, wR ₂ = 0.1156 |
| R factor (all data) | R ₁ = 0.0768, wR ₂ = 0.1272 |
| CCDC ref code | |

Table S1. Crystal Structure and Collection Parameters of PCMOF21-AcO