

Synthesis and characterization of mixed-valence manganese fluorophosphate and analogues with clathrate-like structures:
 $\text{Mn}^{\text{III}}_6\text{F}_{12}(\text{PO}_3(\text{OH}))_8[\text{Na}_8(\text{K}_x(\text{H}_3\text{O})_{4-x}(\text{H}_2\text{O})_2)\text{M}^{\text{IV}}(\text{OH})_6]$ ($\text{M}^{\text{IV}} = \text{Mn, Ti, Ge}$)

Wei-Jian Ren^a, Jing-Quan Wang^a, Ya-Xi Huang^a, Zhi-Mei Sun^b, Yuanming Pan^c, and Jin-Xiao Mi^{a,*}

^a Fujian Provincial Key Laboratory of Advanced Materials, Department of Materials Science and Engineering, College of Materials, Xiamen University, Xiamen 361005, Fujian Province, People's Republic of China

^b School of Materials Science and Engineering, Beihang University, Beijing 100191, People's Republic of China

^c Department of Geological Sciences, University of Saskatchewan, 114 Science Place, Saskatoon, Canada SK S7N 5E2

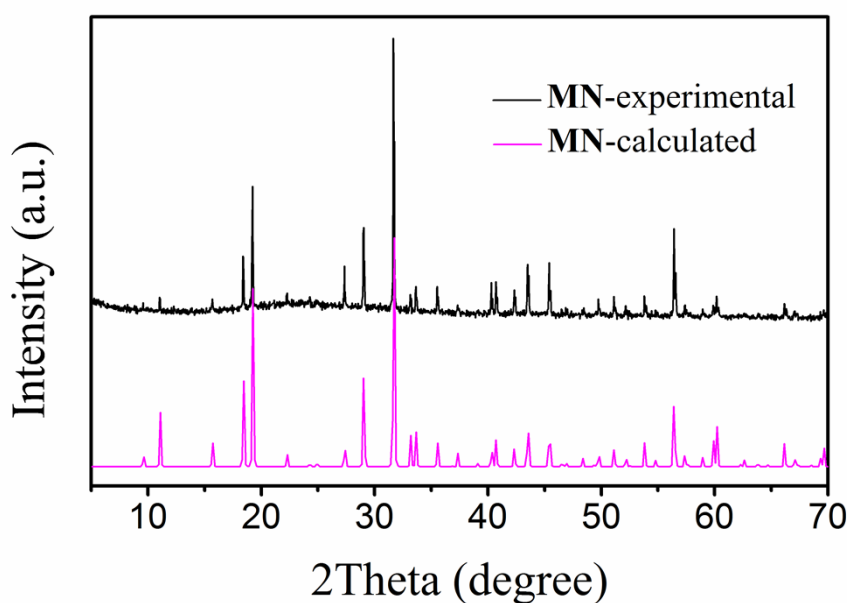


Figure S1 Comparison of the experimental and calculated PXRD patterns of MN.

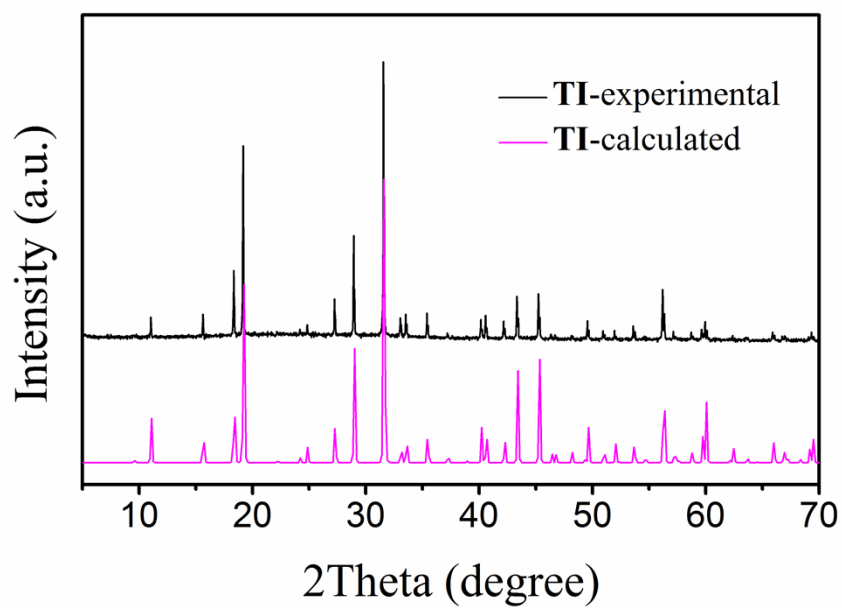


Figure S2 Comparison of the experimental and calculated PXRD patterns of **TI**.

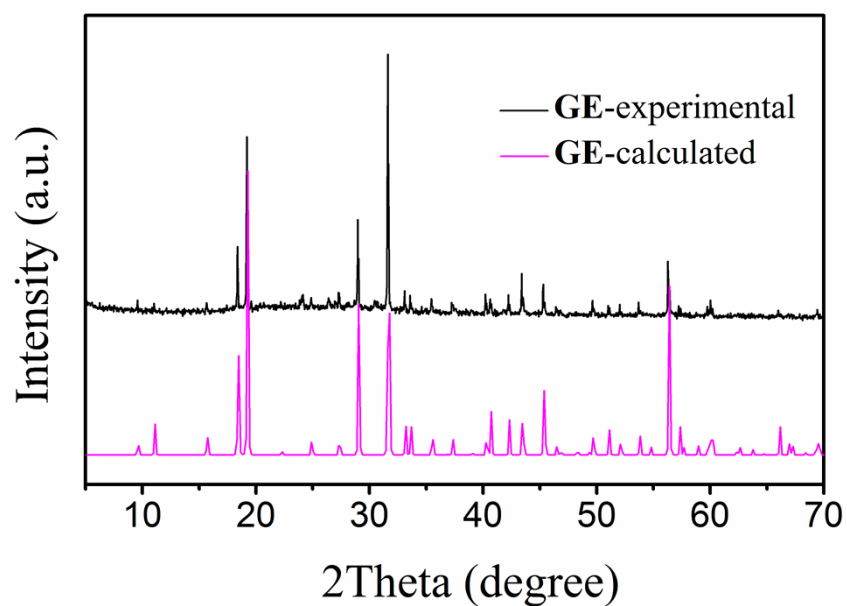


Figure S3 Comparison of the experimental and calculated PXRD patterns of **GE**.

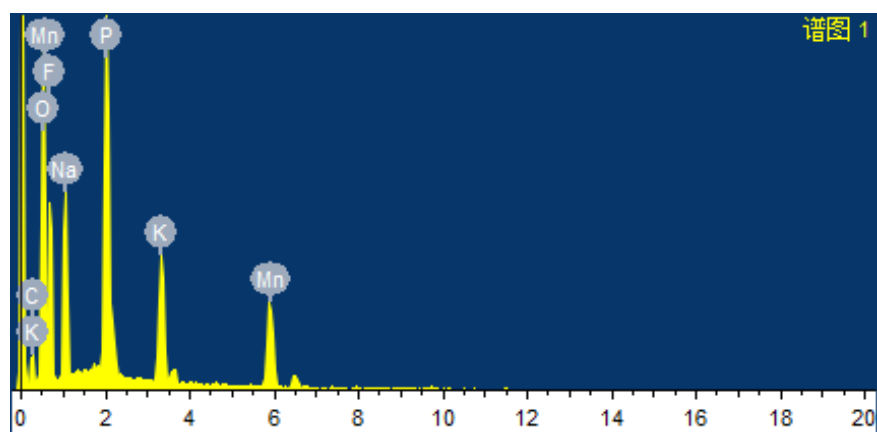
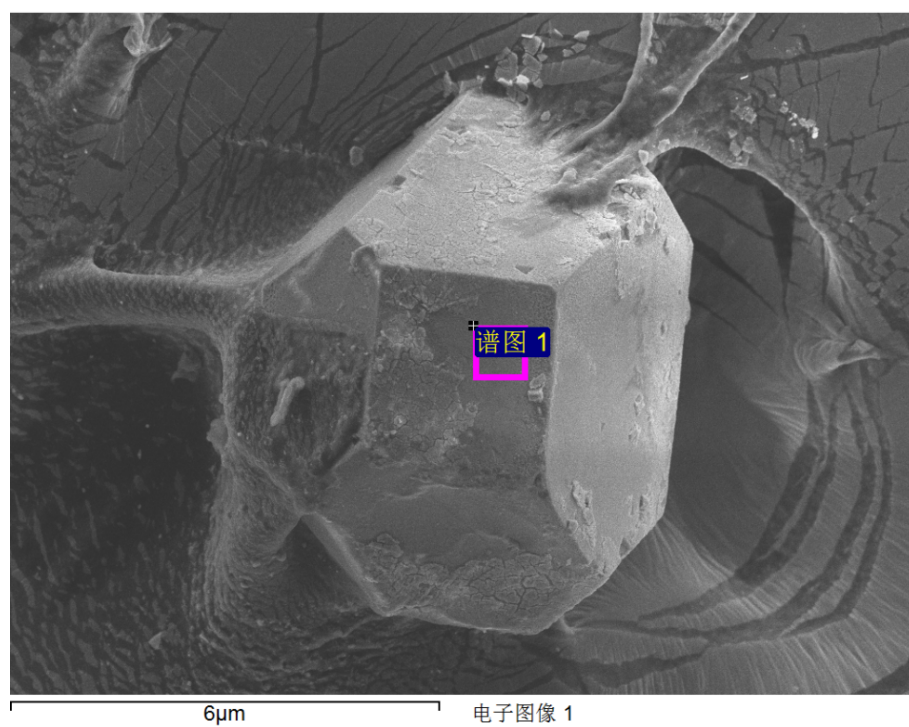
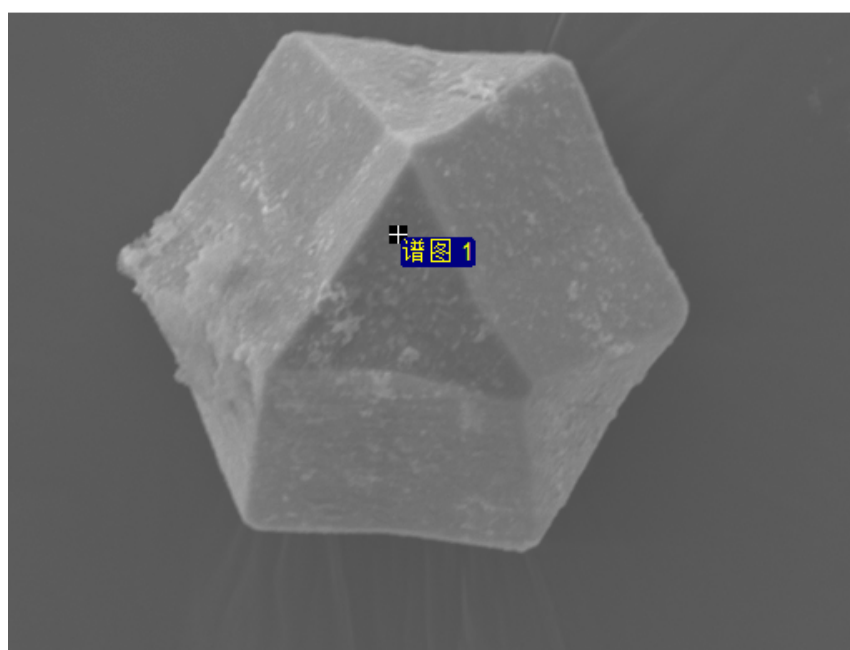


Figure S4 Scanning electron microscope image and EDS spectrum of **MN**.



70μm

电子图像 1

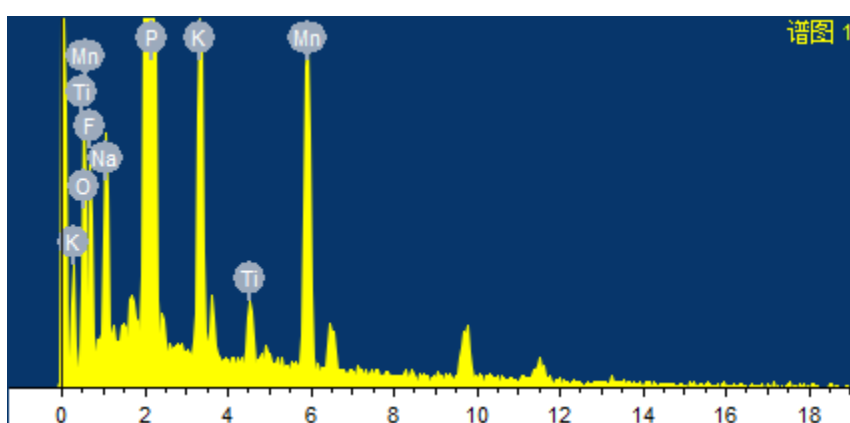


Figure S5 Scanning electron microscope image and EDS spectrum of **TI**

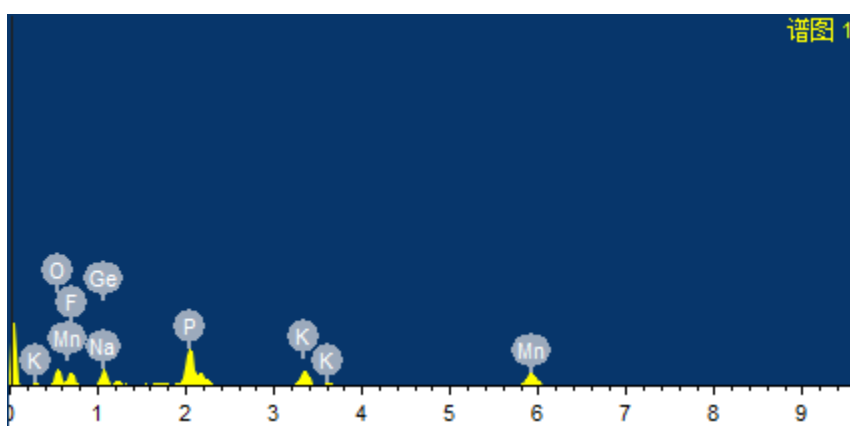
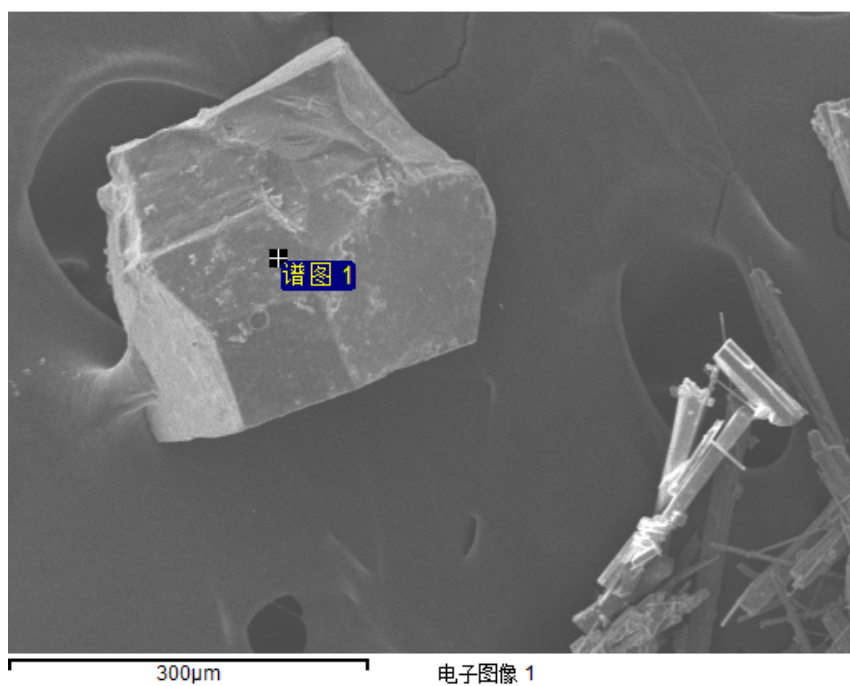


Figure S6 Scanning electron microscope image and EDS spectrum of **GE**.

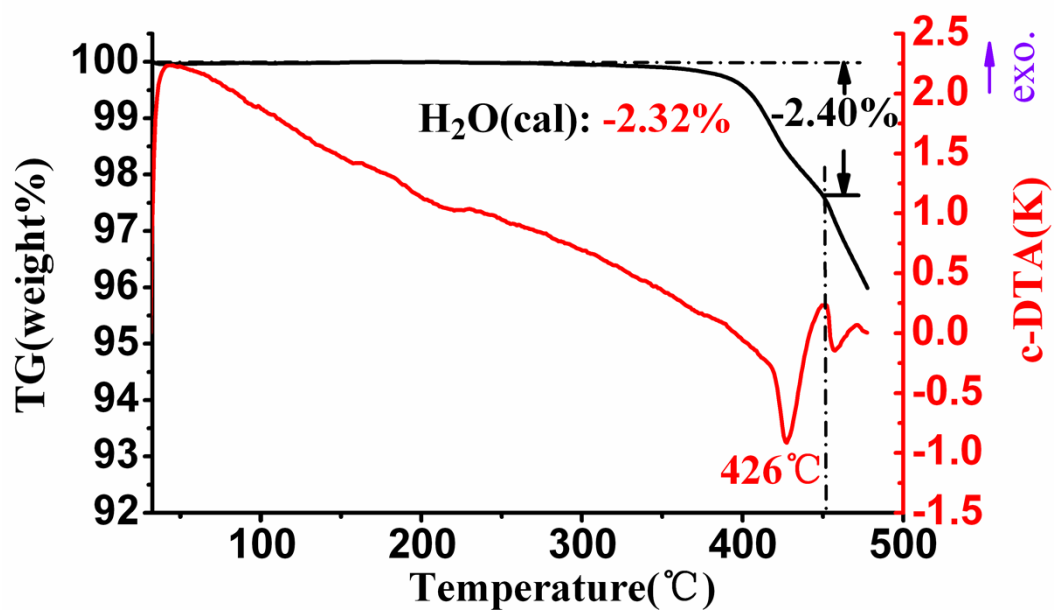


Figure S7 The TG-DTA curves of the compound MN

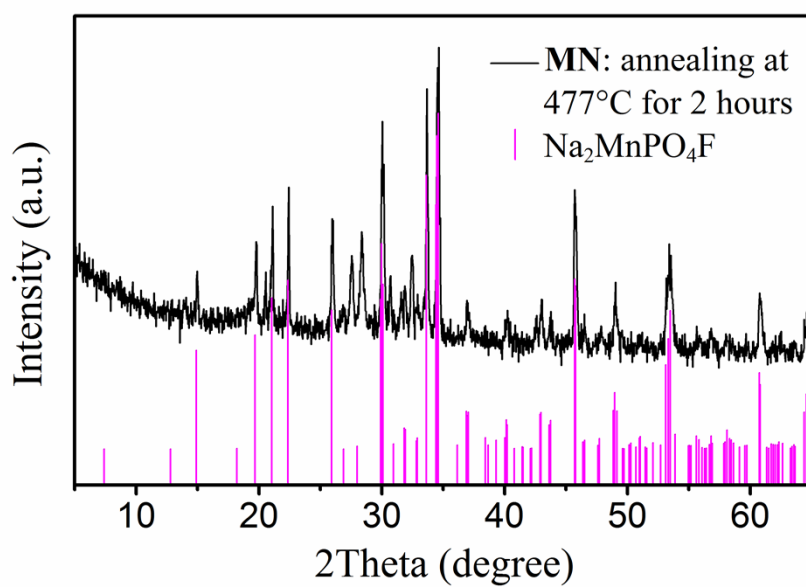


Figure S8 The PXRD pattern of MN after annealed at 477°C for 2h.

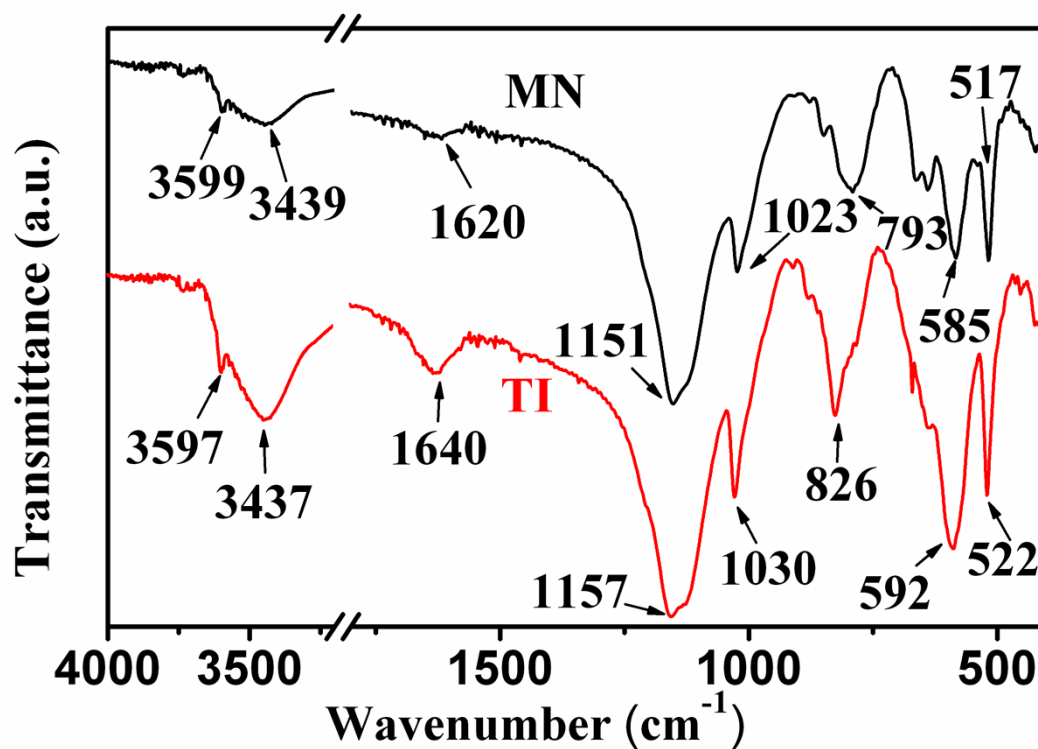


Figure S9 Comparison of FTIR spectra of the compounds MN and TI

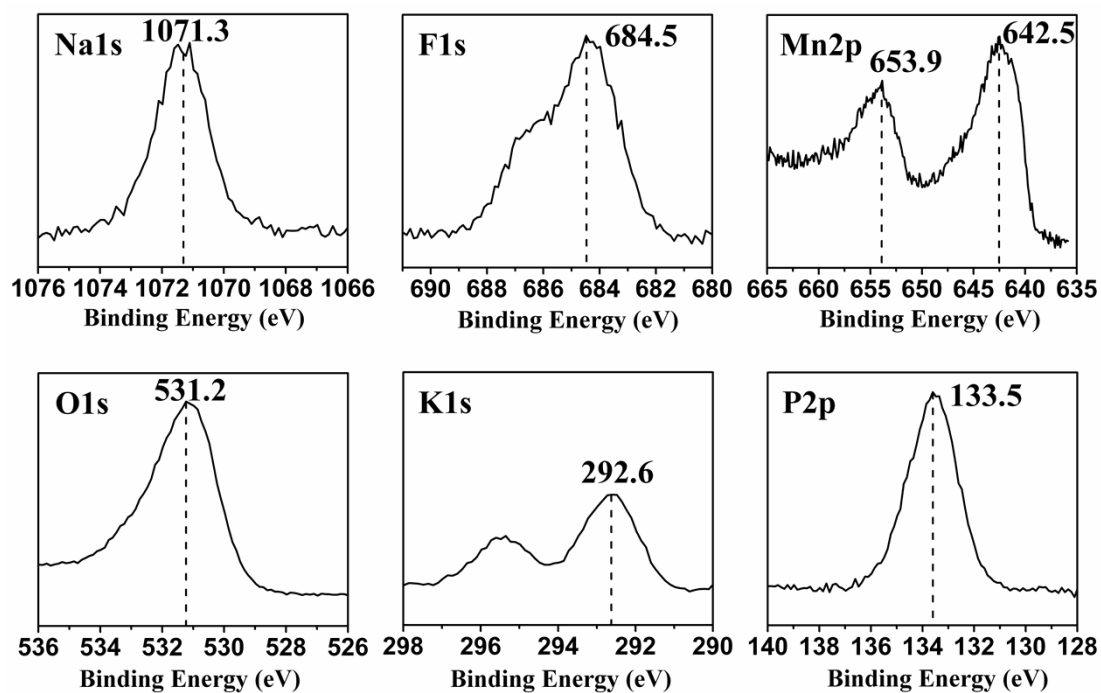


Figure 10 XPS spectra of the compound MN

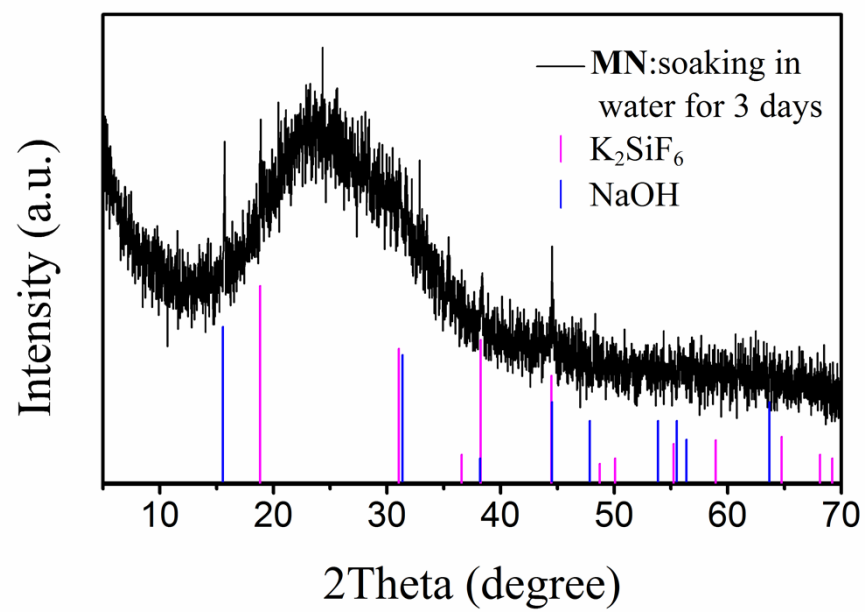


Figure S11 The PXRD pattern of **MN** after absorbed in water.