Supporting information

Defect-induced method for preparing hierarchical porous Zr-MOF materials for ultra-fast and large-scale extraction of uranium from modified artificial seawater

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the stability of UiO-66 is previously reported by lots of relevant literatures. For example, Karl Petter Lillerud et al. published on the Journal of the American Chemical Society with paper title “A new zirconium inorganic building brick forming metal organic frameworks with exceptional stability” investigating the resistance of Zr-BDC MOF toward solvents like water, DMF, benzene, and acetone by stirring the desolvated sample in the solvent for 24 h[1]. Karl Petter Lillerud et al. also found that the stabilities of UIO-66 in water, acid (HCl, pH=1) and base (NaOH, pH=14)[2] and reported their work on the Chemistry Materials with the title “Synthesis and stability of tagged UIO-66 Zr-MOFs”. According to your advice, we selected UIO-66 and HP-UIO-66-35 as representatives, and studied the PXRD and BET images of the materials after immersing into the aqueous solution of pH=8 for 24 h. The images are shown in Fig.S1. It can be seen that the crystallinity of the HP-UIO-66-35 material decreased after the experiment, but the crystal characteristics of UIO-66 still maintained. The BET image shows that the specific surface area drops from 780 m^3/g to 522 m^3/g, which reveals HP-UIO-66-35 is not as stable as the UIO-66 material. However, in terms of the increased adsorption capacity and the fast kinetics, the slight decrease of stability of HP-UIO-66-35 is acceptable.

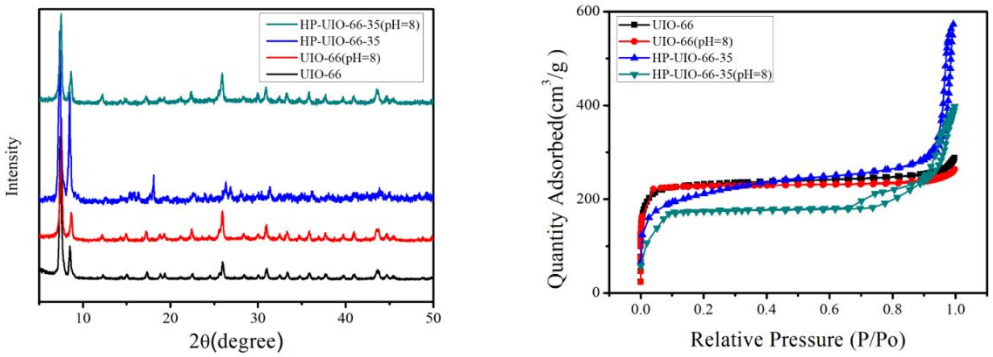

Fig.S1, PXRD and BET images of UIO-66, UIO-66 (pH=8), HP-UIO-66-35, HP-UIO-66-35 (pH=8)

2. M. Kandiah, M. H. Nilsen, S. Usseglio, S. Jakobsen, U. Olsbye, M. Tilset, C. Larabi, E. A. Quadrelli, F. Bonino and K. P. Lillerud, Chemistry of Materials, 2010, 22, 6632-6640.

The prepared HP-UIO-66 material with a hierarchical pore structure formed by a defect induction method. Due to the presence of the inducer, it is difficult to control the growth process of the UIO-66 material to be an octahedral structure. The SEM image of the HP-UIO-66 material is shown in the Fig.S2.

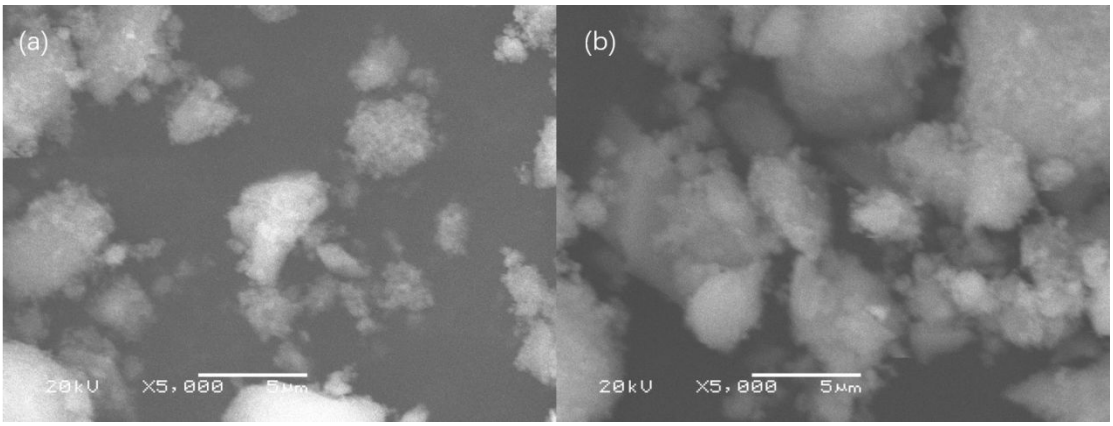

Fig.S2 SEM images of (a) HP-UIO-66-15 and (b) HP-UIO-66-35, respectively.

There is no uranium precipitate under the situation of pH=8, C_0=100 mg/L, t=4h. Fig. S3 shows the digital photos of 100 mg/g uranium solution at pH = 6, 7, 8 for 6 h.

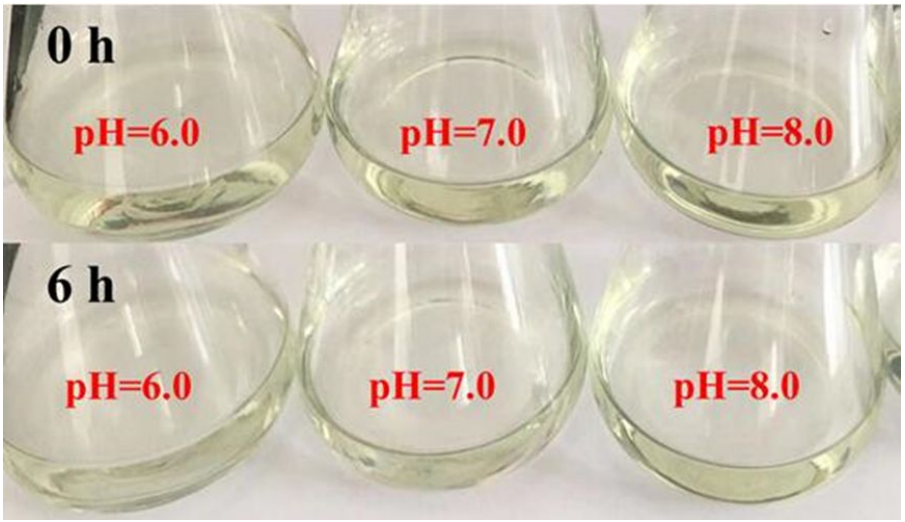

Fig.S3, digital photos of 100 mg/g uranium solution at pH = 6, 7, 8 for 6 h.

Table. S1 The maximum adsorption capacity of different MOF adsorbents for uranium (VI)

Adsorbents	Adsorption Capacity mg-U/g-adsorbent	Condition	Ref.
UIO-68(Zr)-PO_4Et_2	217	C_0=100mg/L, pH =2.5	3
UIO-66(Zr)	109	C_0=100mg/L, pH =5.5, m/V=0.4g/mL	4
UIO-66(Zr)-NH_2	114	C_0=100mg/L, pH =5.5, m/V=0.4g/mL	4
PPy/ZIF-8	534	C_0=400mg/L, pH =3.5, m/V=0.66g/mL	5
GO-COOH/UIO-66	188.3	C_0=100mg/L, pH =8, m/V=0.5g/mL	6
Coumarin-modified microporous–mesoporous Zn–MOF-74	360	C_0=400mg/L , pH =4, m/V=1g/mL	7
Azo-MOFs	312.32	C_0= 200mg/L , pH =5, m/V=0.5g/mL	8
MIL-101-DETA	350	C_0=100mg/L , pH =5.5, m/V=0.4g/mL	9
HP-UIO-66-35	1217	C_0=820mg/L , pH =8, m/V=0.5g/mL	this work

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