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# Efficient capture of actinides from strong acidic solution by hafnium phosphonate frameworks with excellent acid resistance and radiolytic stability

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**Abstract:** A kind of unconventional metal-organic framework (UMOF), hafnium phosphonates (HfP) with different molar fractions P/(P+Hf), were synthesized via a template-free, one-pot method by the reaction between hafnium chloride octahydrate ($HfOCl_2 \cdot 8H_2O$) and amino tris(methylenephosphonic acid) (ATMP); the structure, sorption behaviors for actinides, acid resistance and radiolytic stability of the synthesized materials were then investigated. The results reveal that the materials were amorphous and porous, and HfP with a higher molar fraction P/(P+Hf) exhibited a higher sorption capacity for Th(IV) and U(VI). In 3 mol/L $HNO_3$, $K_d$ values of HfP for Th(IV) and U(VI) were $5.84\times10^4$ and $5.09\times10^3$ mL/g, respectively, indicating superiority to other MOF materials in strong acidic solution. The $K_d$ values for tracer amounts of radioactive $^{239}Pu$ and $^{237}Np$ were $1.19\times10^4$ and $6.68\times10^3$ mL/g in 4 mol/L $HNO_3$, respectively. This is the first case of applying MOF materials to capture transuranic elements from a strong acidic medium. Moreover, the materials were