

Electronic supplementary information

Phosphate Sorption Speciation and Precipitation Mechanisms on Amorphous Aluminum Hydroxide

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SI-1. Synchrotron X-ray Diffraction of Kinetic Samples

The dried and wet samples were loaded into polyimide tubing (Cole Parmer) with an inner diameter of 1 mm by continuously poking on the wet sample films. The ends of tubing were immediately sealed with Epoxy gel (Devcon). Empty and DI water loaded ($18.2 \text{ M}\Omega\cdot\text{cm}$) tubing were also prepared for background subtraction of wet samples. XRD data of wet samples were collected using synchrotron radiation X-ray ($\lambda = 0.4521 \text{ \AA}$) with a sample to detector distance of 65 cm, a total exposure time of 10 s and a PerkinElmer amorphous silicon flat panel detector at beamline 17-BM-B at the Advanced Photon Source (APS), Argonne National Laboratory. Two-dimensional diffraction images were collected with QXRD program and integrated into one-dimensional diffraction patterns by GSAS-II package (Toby and Von Dreele, 2013).

The diffraction data of water loaded tubing were subtracted by empty tubing, which generates diffraction data of water. The wet samples was accomplished by subtracting empty tubing and 87% of water.

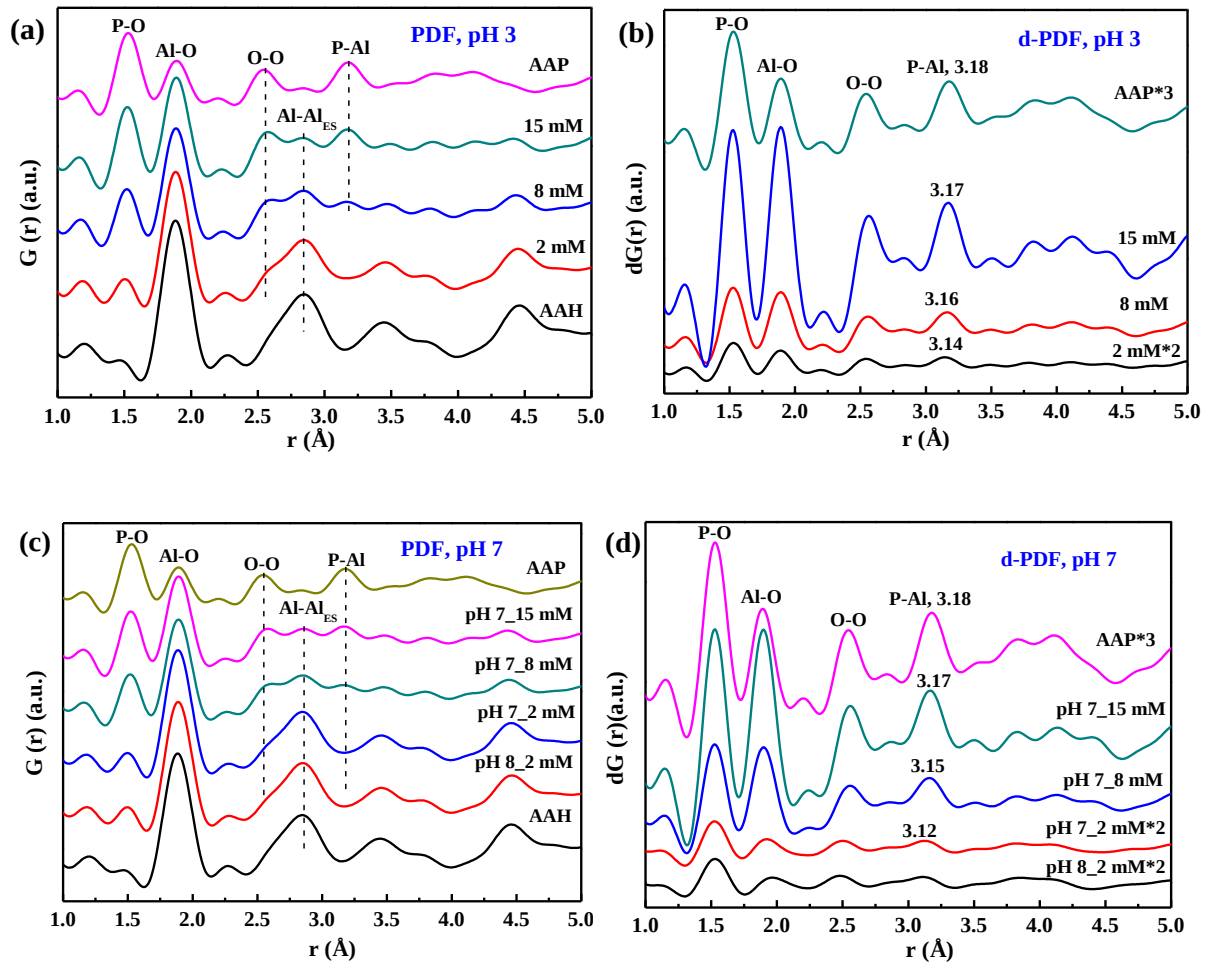


Fig. S1. The pair distribution functions (PDFs) of the dried phosphate sorption isotherm samples at pH 3 (a) and pH 7 (c), and the corresponding differential pair distribution functions (b and d, d-PDFs) obtained by minimizing the Al–Al peak at 2.85 Å. The title “r” of the X axis stands for the atomic distance; the data in each panel are stacked in the order of increasing initial P concentration from the bottom to the top. AAH and AAP are included as the references.

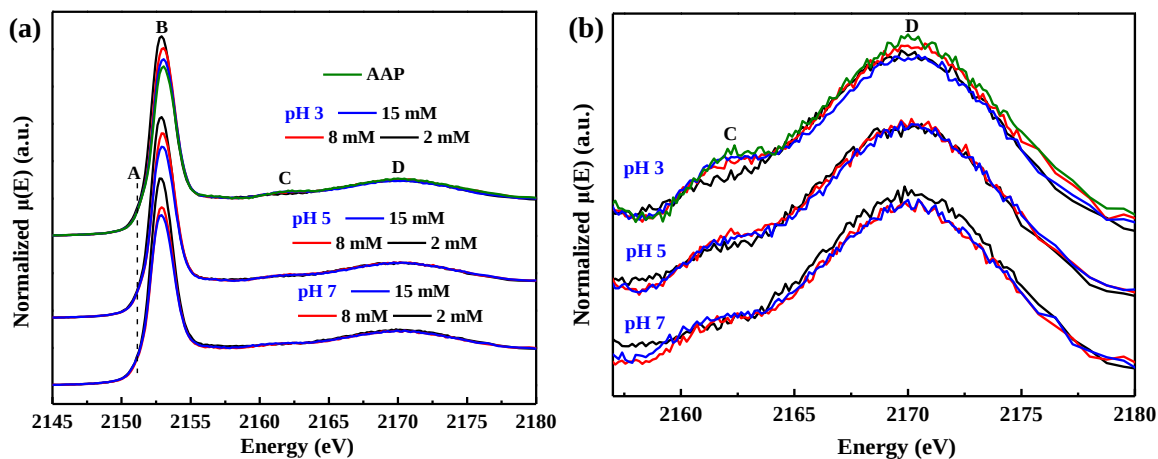


Fig. S2. P K-edge XANES spectra in the energy range of 2145 – 2180 eV (a) and 2148 – 2180 eV (b) for the phosphate sorption isotherm samples prepared at different pHs and initial P concentrations. The spectra of AAP is included as the reference.

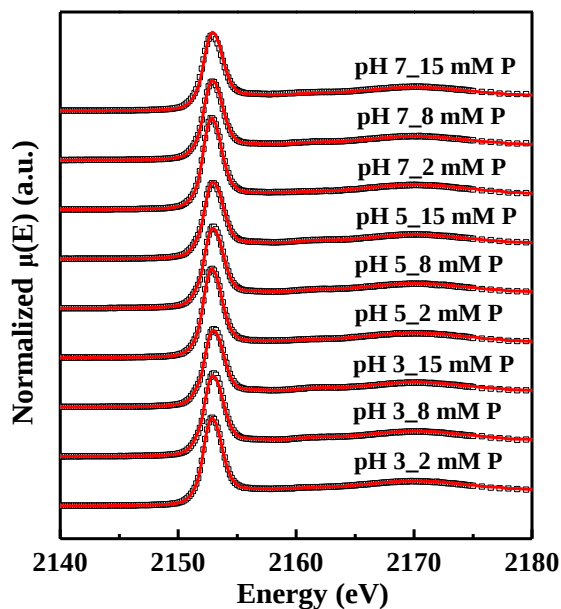


Fig. S3. Comparison of the P spectra (black dot) and their linear combination fits (red line) for determining the relative fractions of precipitation and adsorption in P sorption isotherm samples prepared at different pHs and initial P concentrations.

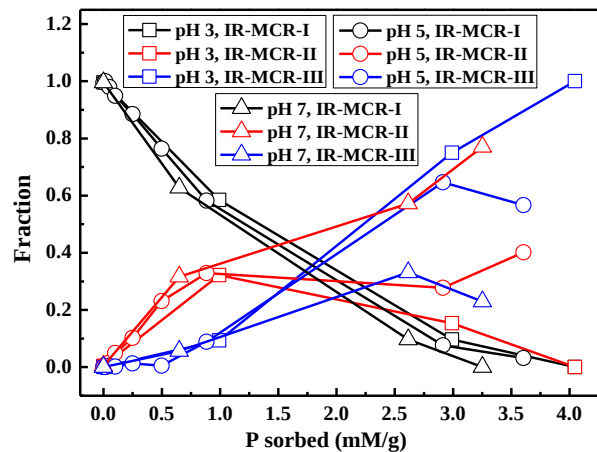


Fig. S4. The relative proportions of the components identified by multiple curve resolution (MCR) analyses of ATR-FTIR spectra for the phosphate sorption isotherm samples prepared at pH 3, 5, and 7.

References

Toby, B.H. Von Dreele, R.B., 2013. GSAS-II: the genesis of a modern open-source all purpose crystallography software package. J. Appl. Cryst., 46, 544-549.