Electronic Supplementary Material (ESI) for RSC Advances.

A simple and convenient method to fabricate new types of phytic acid-metal conversion coatings with excellent anti-corrosion performance on the iron substrate

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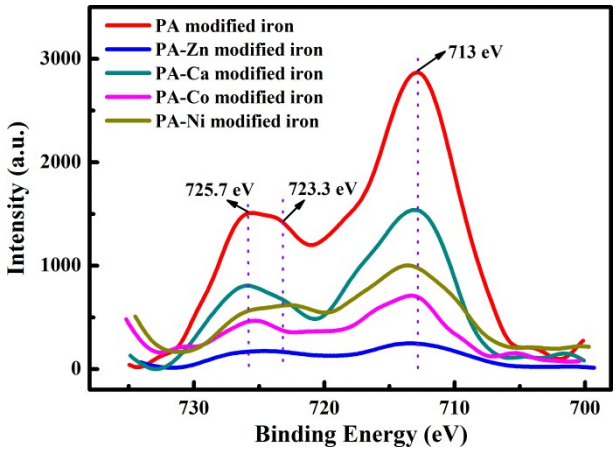

Fig. S1. High resolution XPS spectra of the iron element from diffierent PA-based coatings.

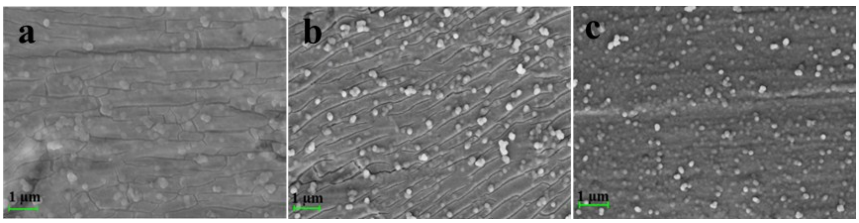

Fig. S2. SEM images of PA-Ca coatings obtained at different self-assembly times: 5 min (a), 10 min (b), and 15 min (c).

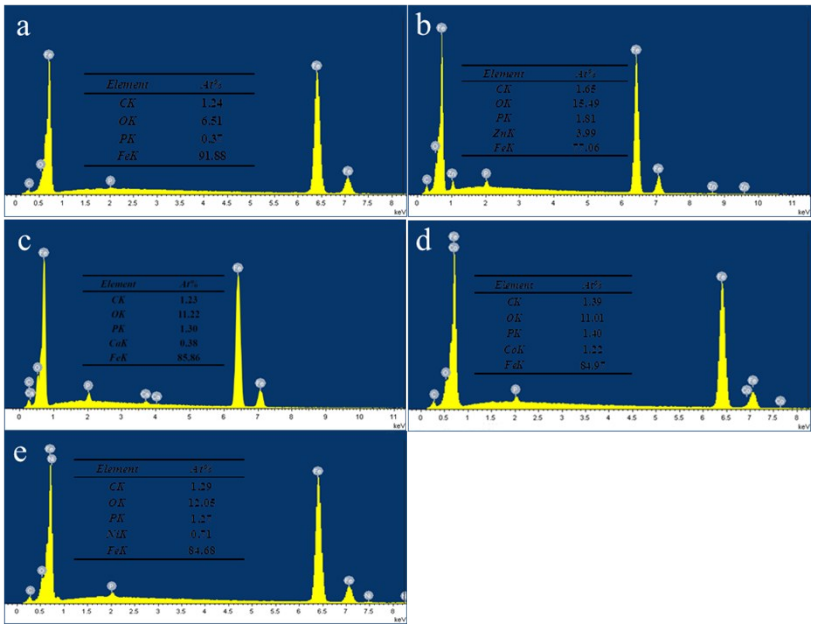

Fig. S3. EDS spectra and atomic percentages of main elements for different iron samples coated with PA film (a), PA-Zn coating (b), PA-Ca coating (c), PA-Co coating (d) and PA-Ni coating (e).

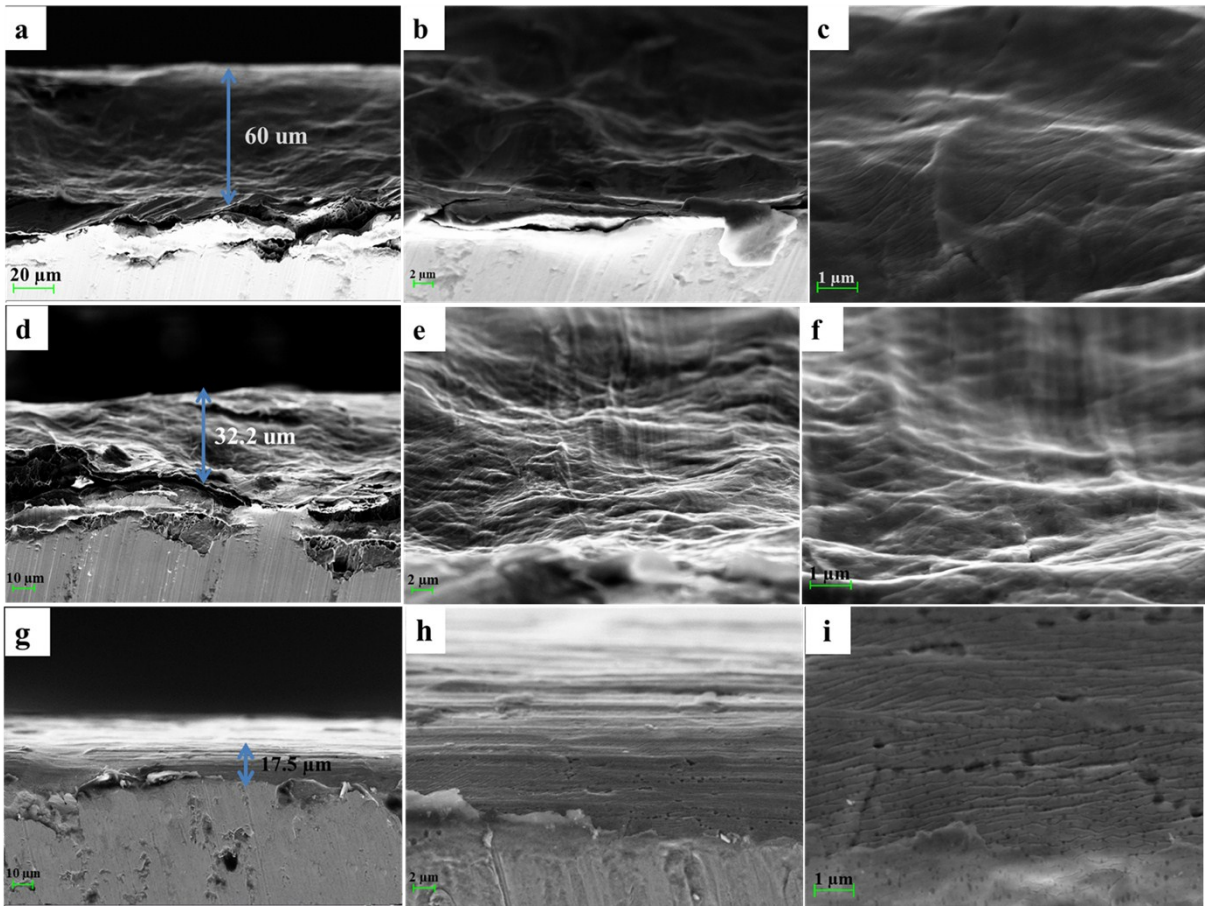

Fig. S4. Cross-sectional SEM images of the iron samples coated with PA-Ca coating (a, b, c), PA-Co coating (c, d, e) and PA-Ni coating (g, h, i).

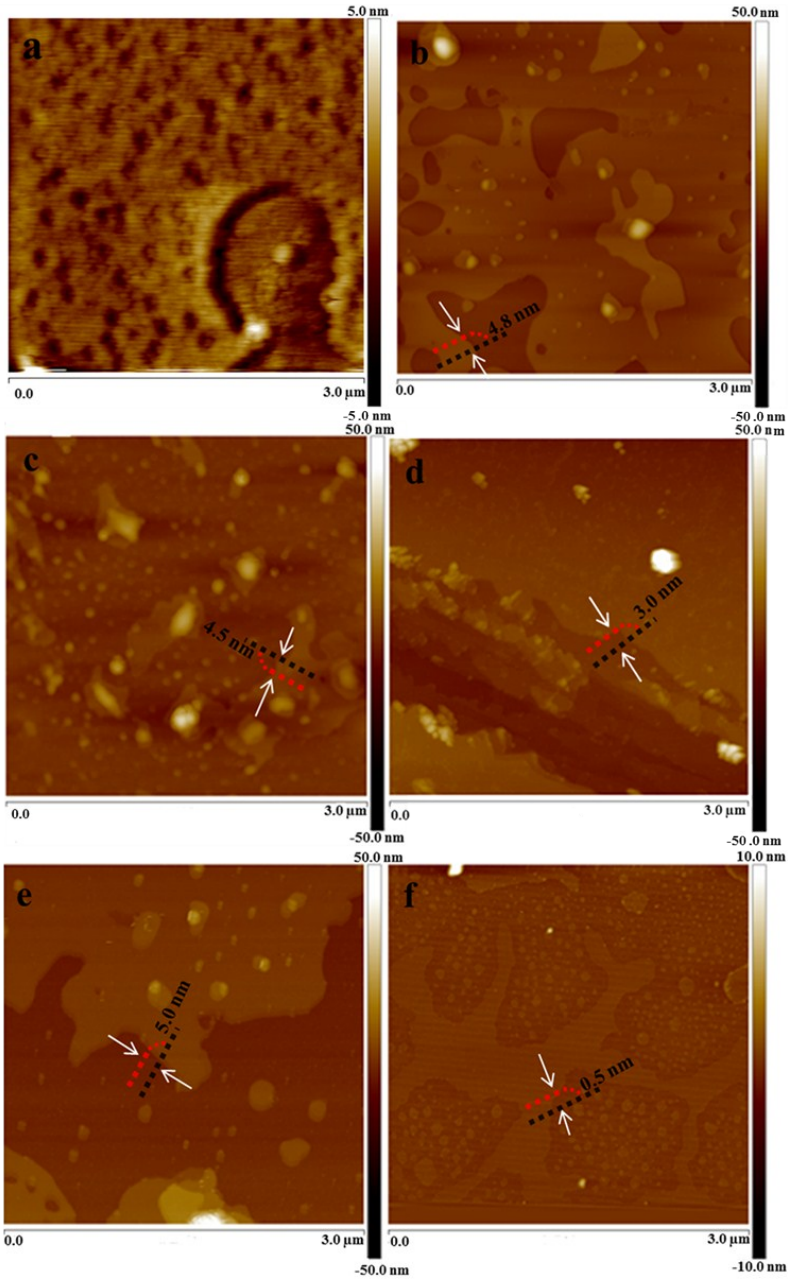

Fig. S5. Representative AFM images of the PA film (a) and the extracts of different metal phytates: zinc phytate (b), calcium phytate (c), cobalt phytate (d) and nickel phytate (e), and single-layer nickel phytate with the sheet structure (f). AFM samples were prepared by using mica sheet as the substrate and all images were obtained from the mica sheet samples.

S6. AFM characterization of PA film and metal phytate film

Metal phytate (metal polyphosphates) powders, as major film-forming components, were extracted and dissolved in aqueous solution. The AFM samples were prepared by dropping the aqueous solution onto a mica sheet and dried under nitrogen atomsphere. Then AFM measurement was carried out to characterize the morphological features of the mica sheet samples, as shown in Figs.S5(b-f). Meanwhile, the surface of a mica sheet treated with the PA aqueous solution was also

observed using AFM. The PA film formed on the mica sheet showed a mesh structure which contained many holes with the diameter of ~130 nm (see Fig.S5a). When PA co-existed with metal ions (*e.g.* Zn^{2+}, Ca^{2+}, Co^{2+} and Ni^{2+}) in aqueous solution, the thin films formed by metal phytate abstracts all displayed the similar lamellar structure, except there were some spherical particles in the calcium phytate thin film. The thinnest lamellar structure observed from the nickel phytate film was about 0.5 nm thick, which can be supposed to the thickness of monolayer metal phytate. Therefore, it is believed that the lamellar structures of metal phytate abstracts were composed of successive layers of PA molecules. In summary, the metal ions that co-existed with PA worked as the bridging agent to connect individual PA molecules and promote layer-by-layer growth of PA-metal complexes.