Supporting Information

Developing a jujube cake structured composite filler SiO₂@PHT-1 for preparing

a pH-indicating film with high pH measurement precision and strong reusability

Yurou Chen¹, Yili Wei¹, Wenjun Song¹, Yiwen Zhang¹, Wenjie Tan¹, Jun Li^{1,2}, Shun $Wang^{1,2}$, Yadong $Wu^{1,2*}$ and Huile Jin^{1,2*}

¹ Wenzhou Key Lab of Advanced Energy Storage and Conversion, Zhejiang Province Key Lab of Leather Engineering, College of Chemistry and Materials Engineering, Wenzhou University, Wenzhou, Zhejiang 325035, China;

² Zhejiang Engineering Research Center for Electrochemical Energy Materials and Devices, Institute of New Materials and Industrial Technologies, Wenzhou University, Wenzhou, Zhejiang 325025, China

* Corresponding authors

E-mail: 20210574@wzu.edu.cn (Y.D. Wu); huilejin@wzu.edu.cn (H.L. Jin)



Fig. S1. (a) SiO₂@PHT-1 in the dark field; the images of SiO₂@PHT-1 in polarized light: (b) crystallographic, (c) 2D and (d) 3D images.



Fig. S2. Color comparison of the indicator film FKM/SiO₂@PHT-1 in the same alkaline solution and at different temperatures (pH of the solution used was 14).

We conducted in situ optical microscopy to dynamically track the PHT growth process. The Fig. S3 unequivocally demonstrates silica's persistent role during crystallization, wherein it progressively assembles into a gradient protective layer on PHT particle surfaces. This layer spatially confines PHT crystal growth.



Fig. S3. Screenshot of video of composite filler growth process.

To systematically evaluate the effect of chloride ions and organic contaminants on the color development of indicator films, we performed comprehensive validation experiments by immersing the indicator membranes in (1) urea solution and (2) hydrochloric acid solution in a pH gradient solution. As shown in the Fig. S4, immersion of the pH indicator film in urea solution and chloride-containing ion solution did not show any color, indicating that ionic and organic contamination did not interfere with the pH indication of the film.



Fig. S4. Effect of chloride ions and organic contaminants on the color development of indicator films.