Supporting Information

In situ construction of magnesium foliar fertilizer with pH-controlled release and high adhesion capacity

Wenchao Li,[a,b] Xinyuan Zhang,[a,b] Hongjian Zhou,*[,a,b] Zidan Zou,[a,b] Yue Shen[a,b] and Guozhong Wang *[,a,b]

[a] *Key Laboratory of Materials Physics, Centre for Environmental and Energy Nanomaterials, Anhui Key Laboratory of Nanomaterials and Nanotechnology, Institute of Solid State Physics, HFIPS, Chinese Academy of Sciences, Hefei, 230031 P. R. China.*

[b] *Science Island Branch of Graduate School, University of Science and Technology of China, Hefei 230026, P. R. China.*

** Email address: hjzhou@issp.ac.cn (H. Zhou) and gzhwang@issp.ac.cn (G. Wang)*

Materials

Hydrochloric acid (HCl), ammonium hydroxide ($NH_3 \cdot H_2O$, 25%-28%), anhydrous ethanol (C_2H_5OH), ammonium chloride (NH_4Cl) and sodium hydroxide (NaOH) were purchased from the Sinopharm Chemical Reagent. Magnesium chloride hexahydrate ($MgCl_2 \cdot 6H_2O$), magnesium sulfate heptahydrate ($MgSO_4 \cdot 7H_2O$), magnesium nitrate hexahydrate ($Mg(NO_3)_2 \cdot 6H_2O$), tetraethyl orthosilicate (TEOS) were received from Aladdin reagent (Shanghai) Co. Ltd. All purchased reagents were analytically pure without further treatment. Deionized water with a specific resistance larger than 18 MΩ was used throughout the whole experiments. Tomato seeds in this study were obtained from Shouguang City, Shandong Province, China and kept sealed until use. The tomato leaves cut into 3 cm^2 are picked from the tomato seedlings in the

plant growth chamber.

Characterization

The structure and morphology measurements of PMFF were performed with a field emission scanning electron microscope (SEM, SU8020, 10kV) with an energy dispersive X-ray spectrometer (EDS Oxford, Link ISIS) at an acceleration voltage, and transmission electron microscope (HRTEM, JEOL2010) with X-ray energy dispersive spectroscopy (EDS) capabilities, operated at an acceleration voltage of 200 kV. The phase and crystallinity were analyzed by X-ray diffractometer (XRD, Philips, X'Pert-PRO, The Netherlands) with Cu Kα radiation (λ = 1.5478 Å) at 40 keV and 40 mA in the 2θ range of 10-80°. The pore size distribution and specific surface area of the samples were performed by Brunauer-Emmett-Teller (BET) and Barrett-Joyner-Halenda (BJH) methods by using an automatic gas adsorption analyzer (Autosorb-iQ-Cx), respectively. The released amount of magnesium was determined by inductively coupled plasma-atomic emission spectrometer (ICP-AES, ICP-7000, Thermo Fisher Scientific, USA). The hydrophilicity and hydrophobicity of the MFF on the tomato leaf surface was measured by the contact angle tester (Solon Tech. (Shanghai) Co., Ltd). The chlorophyll contents of tomato leaves were determined by chlorophyll meter (SPAD-502 plus, Konica Minolta Investment Ltd., Japan).

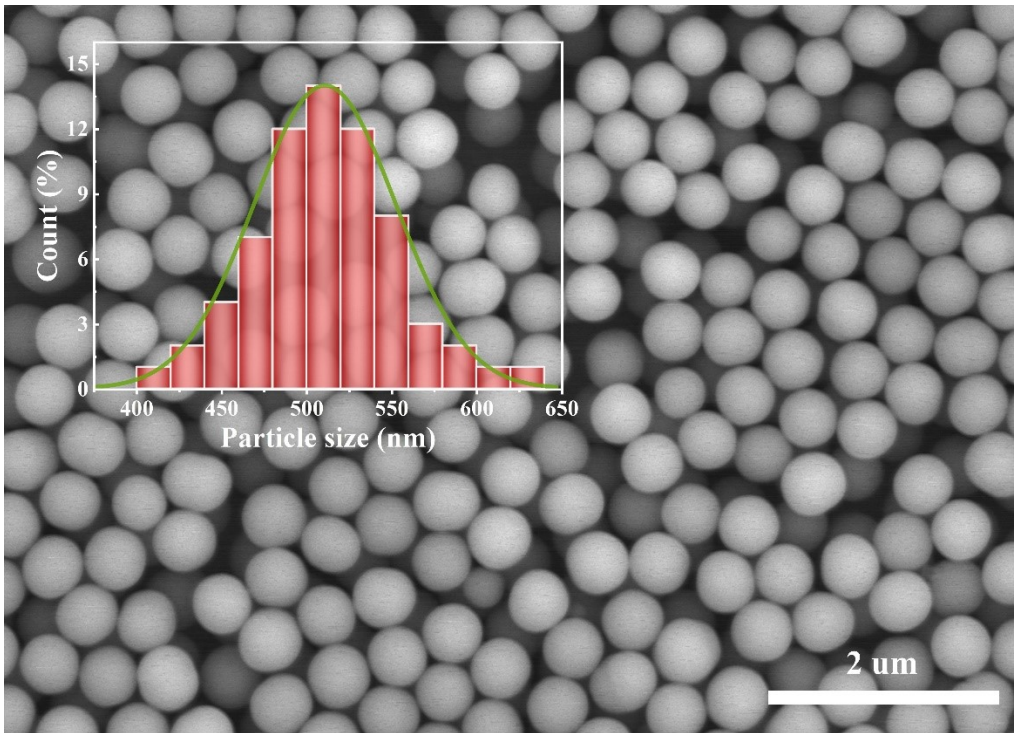

Fig S1. SEM image of nano silica template with the size distribution curve (inset).

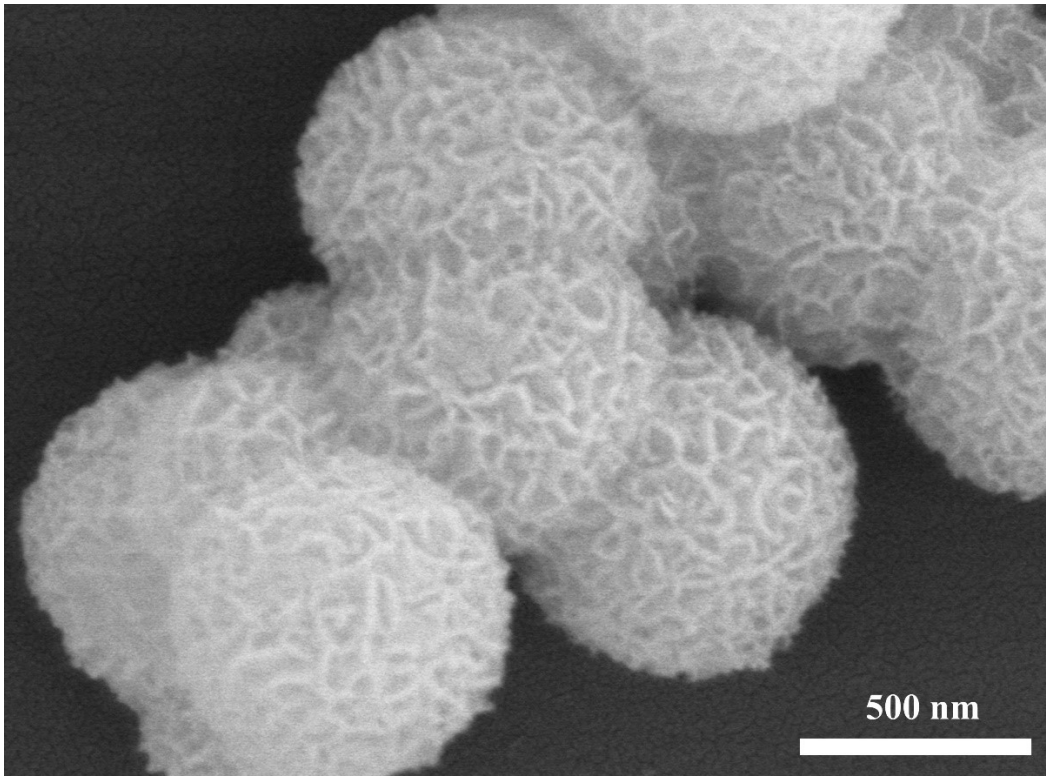

Fig S2. SEM image of PMFF-D.

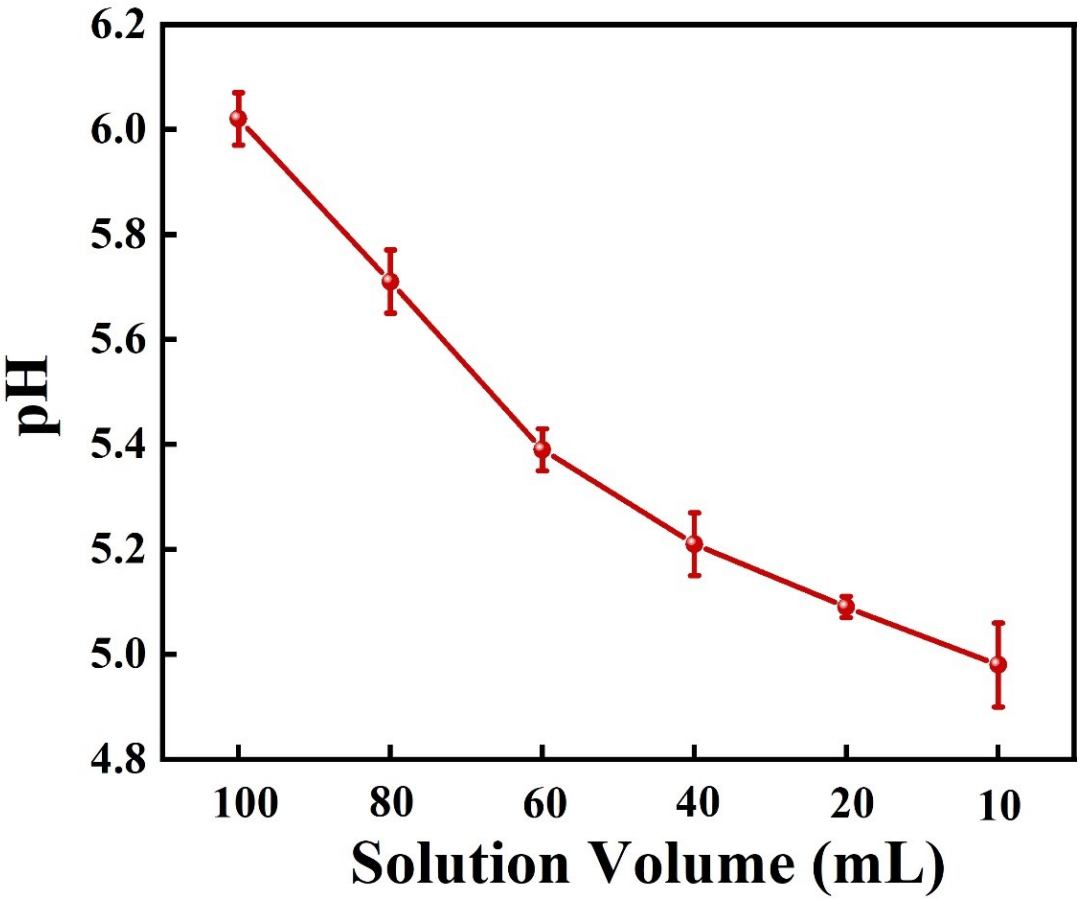

Fig S3. In vitro experiments simulate the pH changes of droplets on the foliar surface with volume evaporation.

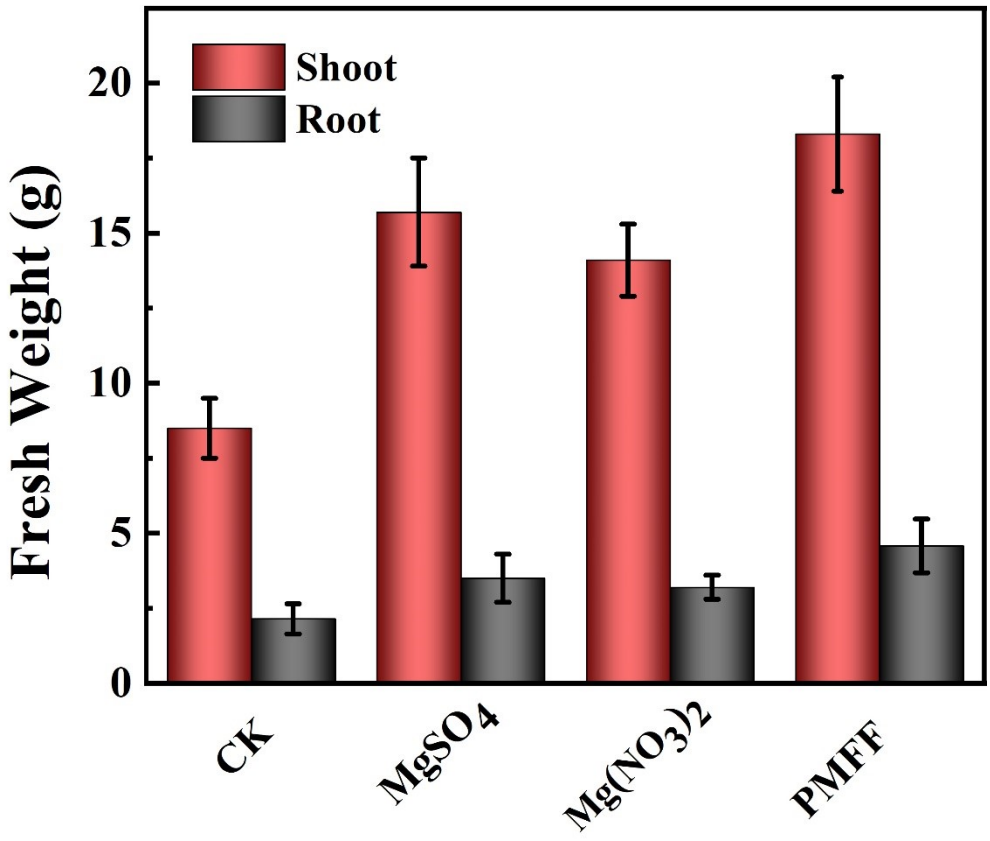

Fig S4. Fresh weight of tomato seedlings sprayed with deionized water, $MgSO_4$, $Mg(NO_3)_2$, and PPMFF solution.

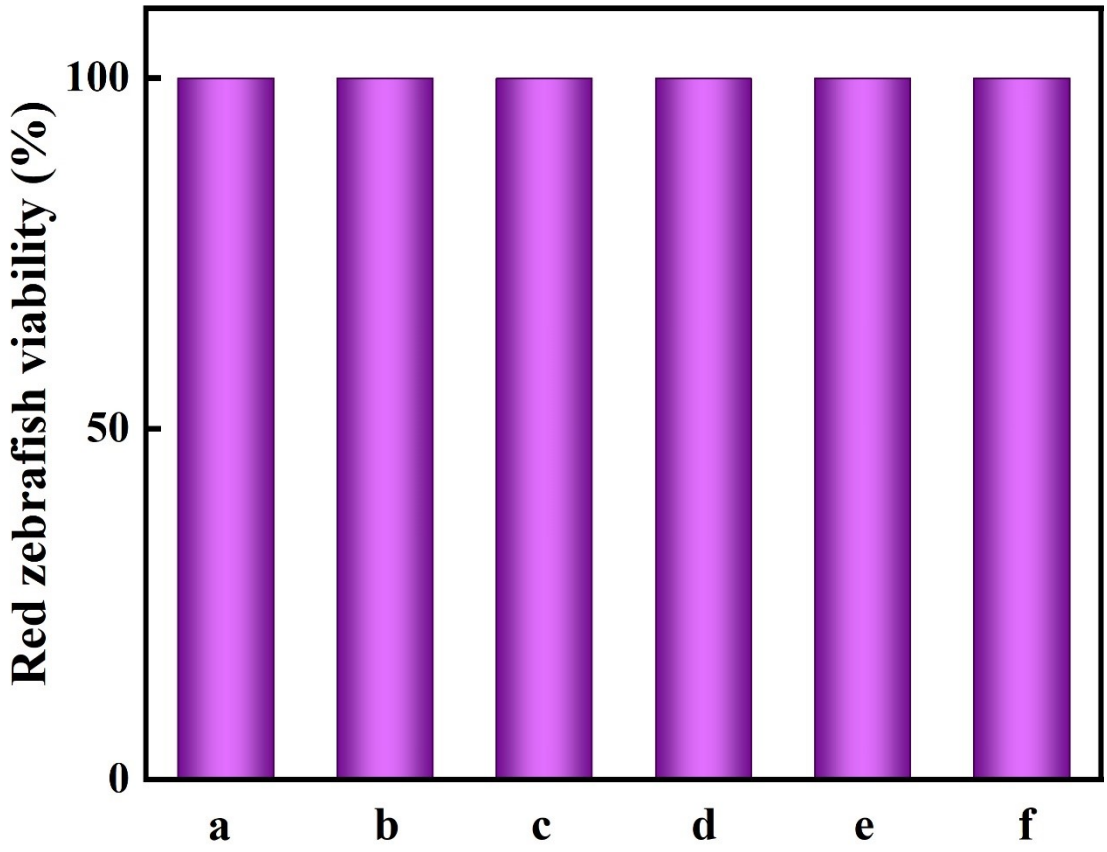

Fig S5. Viability of red zebrafish in water with PPMFF concentrations of (a) 0, (b) 0.20, (c) 0.40, (d) 0.60, (e) 0.80, (f) 1.0 g L^{-1}.