

Electronic Supplementary Information (ESI) for

Ratiometric Fluorescence Sensing of Temperature Based on Perovskite Nanocrystals and Rhodamine B doped Electrospinning Fibers

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1. Experimental

1.1 Materials and reagents

All the materials and chemical reagents were used as received without any further purification. Lead bromide (PbBr_2), methylamine (CH_3NH_2 , 30-33 wt % methanol), hydrogen bromide (HBr, 48 wt %), Rhodamine B (RhB), poly (vinylidene fluoride) (PVDF, average molecular weight of 400,000), polymethyl methacrylate (PMMA, average molecular weight of 35,000), polystyrene (PS, average molecular weight of 280,000), polyacrylonitrile (PAN, average molecular weight of 149000~150,000), N, N-dimethylformamide (DMF), ethanol ($\text{CH}_3\text{CH}_2\text{OH}$) and diethyl ether ($\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$) were purchased from Aladdin.

1.2 Characterizations

The morphology of fibers were characterized using scanning electron microscope (SEM, Tecnai-G2-F30) and transmission electron microscopy (TEM, JEM-2100). Crystal structure of samples were determined via X-ray diffraction (XRD, Rigaku Ultima IV). Ultraviolet-visible absorption (UV-Vis) were performed on a ultraviolet spectrophotometer (USB2000+UV-VIS) with solid sample holder. Fluorescence spectra were acquired by fluorescence spectrophotometer (Agilent). Electrospinning fibers were synthesized by electrospinning equipment (Luna Technology Co., Ltd.). Thermogravimetric analysis (TGA) of the fibers was carried out using a DTA8122 thermal analyzer (RIGAKU) at heating rates of $20\text{ }^\circ\text{C min}^{-1}$ from $30\text{ }^\circ\text{C}$ to $800\text{ }^\circ\text{C}$ in nitrogen atmosphere. Fluorescence images of fibers were obtained by inverted fluorescence microscope (MF31).

1.3 Preparation of MABr

15 mL HBr and 10 mL CH_3NH_2 were slowly mixed in a 150 mL flask under stirring at $0\text{ }^\circ\text{C}$ to form a clear transparent solution. After heating the solution to $70\text{ }^\circ\text{C}$ for 12 h, a white solid was obtained. The solid was washed with ethanol for three times and then recrystallized in diethyl ether. The purified product was dried at $80\text{ }^\circ\text{C}$

for 3 h in a vacuum and stored at room T .

1.4 Fabrication of MAPbBr₃&RhB@PAN fibers

5.5 mL DMF was mixed with 10 mg PbBr₂, 3 mg MABr and 1.0 g PAN under vigorous stirring for 12 h at 30 °C. The precursor solution was transferred into a 5 mL syringe. During the electrospinning process, the solution feed rate was set at 0.5 mL h⁻¹ with apparatus operating electric voltage of 15 kV. The syringe and the metallic collector distance was 20 cm and the fibers were collected for approximately 2 h. The MAPbBr₃&RhB@PAN fibers were obtained in a similar way to MAPbBr₃@PAN fibers. 5.5 mL DMF was mixed with 10 mg PbBr₂, 3 mg MABr, 1 mg RhB and 1.0 g PAN under vigorous stirring for 12 h at 30 °C. And then the MAPbBr₃&RhB@PAN fibers were obtained by electrospinning process. Other concentration fibers synthesis reported in this study were carried out using similar ways as above at different concentration of MAPbBr₃ and RhB.

2. Supplemented Figures

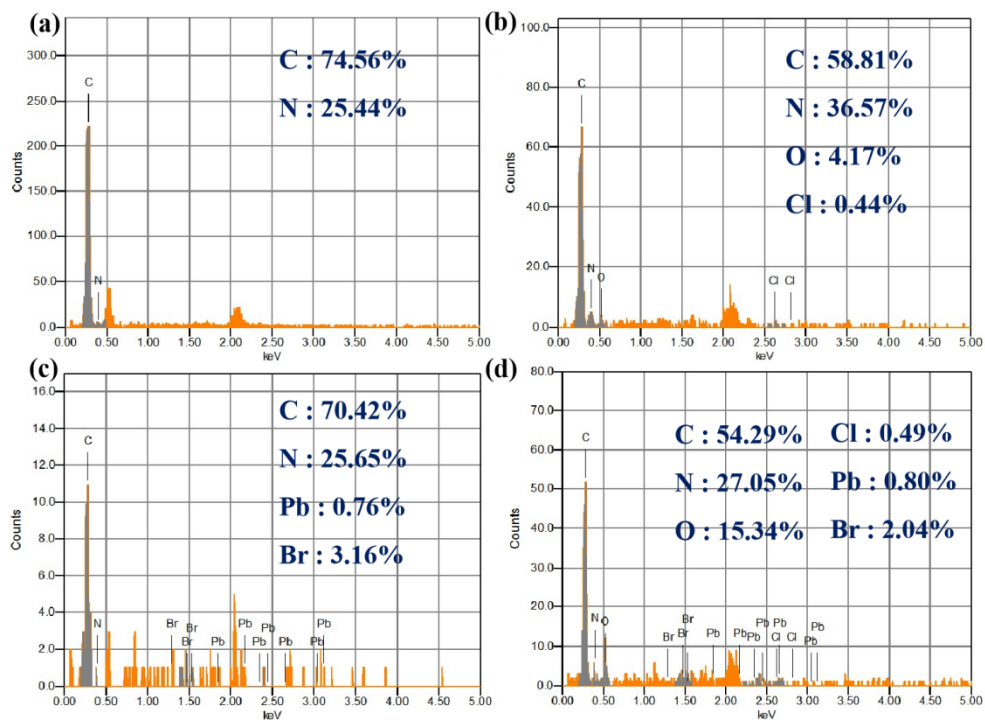


Figure S1. EDS spectrum of the (a) PAN fibers, (b) RhB@PAN fibers, (c) MAPbBr₃@PAN fibers and (d) MAPbBr₃&RhB@PAN fibers.

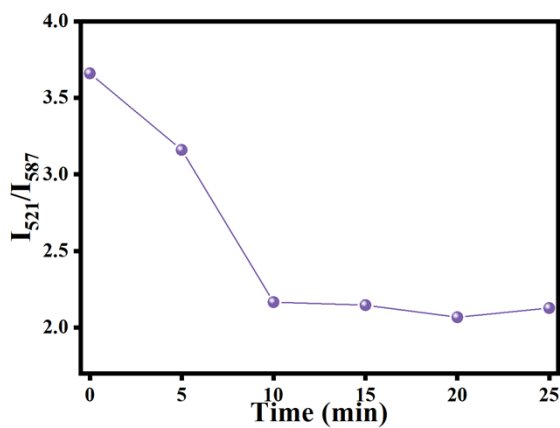


Figure S2. The response time of MAPbBr₃&RhB@PAN fibers at 45 °C.

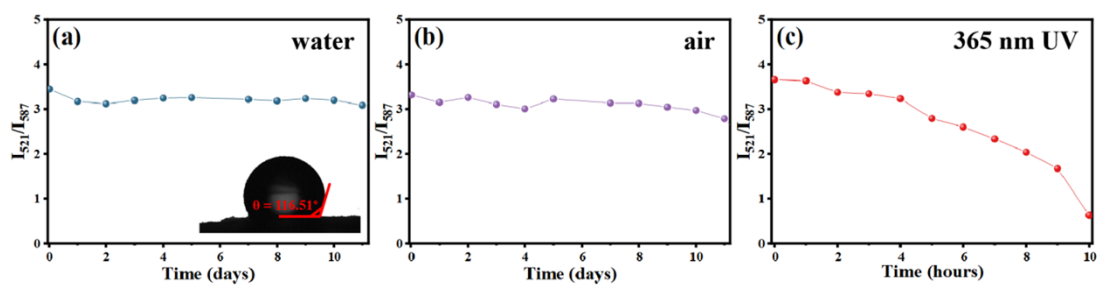


Figure S3. The stability of MAPbBr₃&RhB@PAN fibers (a) in water (the insert picture of fibers water contact angle values), (b) in air and (c) in 365 nm UV light.

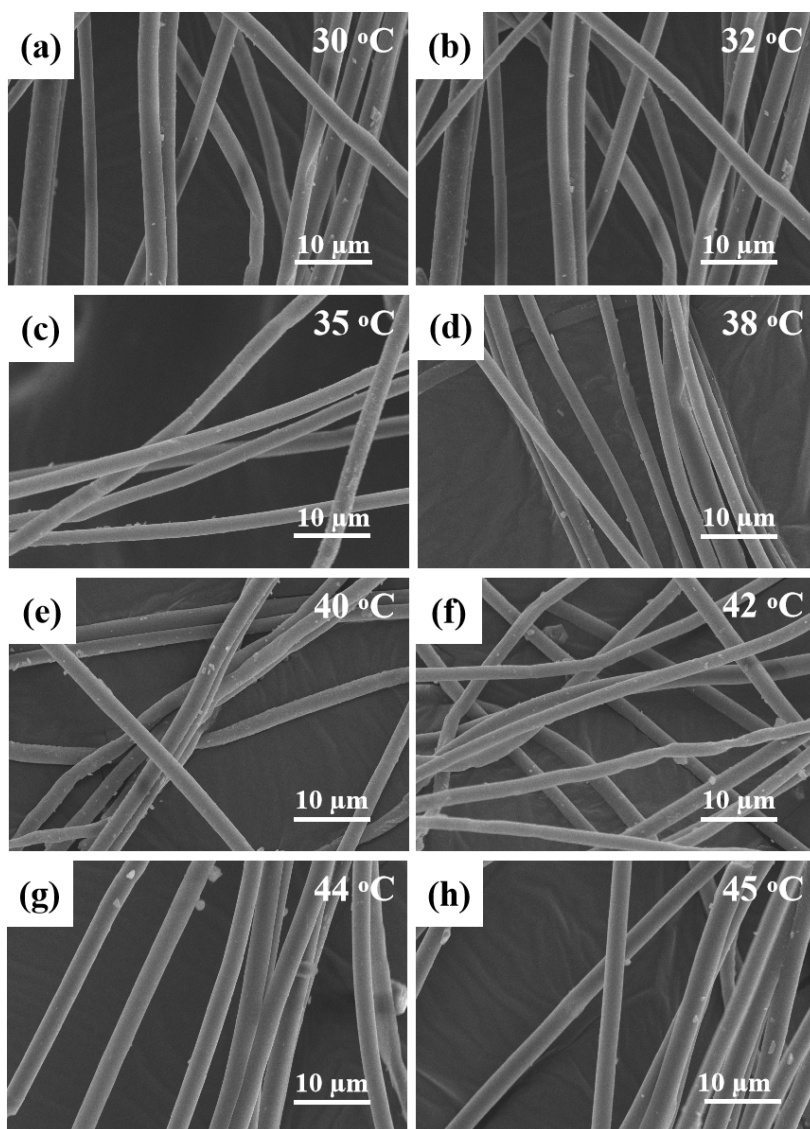


Figure S4. The SEM images of MAPbBr₃&RhB@PAN fibers in different T .

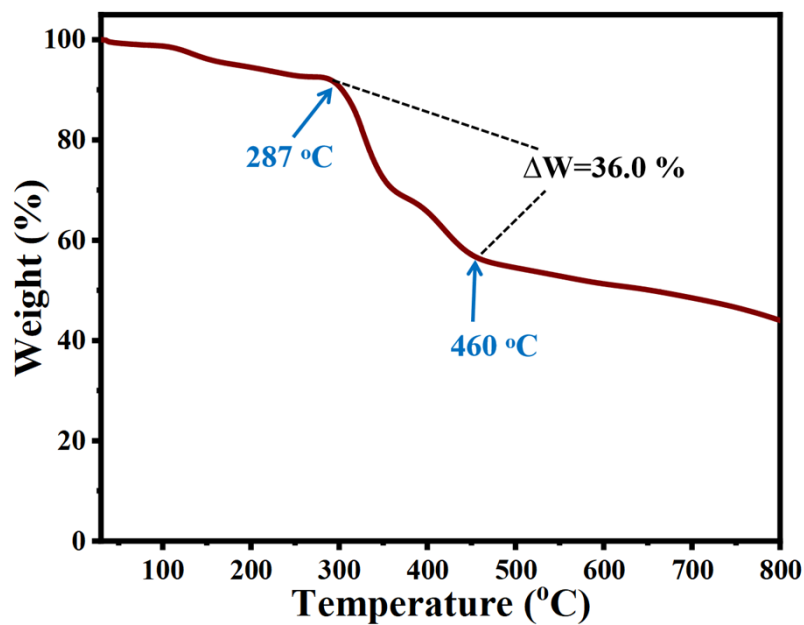


Figure S5. TGA of MAPbBr₃&RhB@PAN fibers.

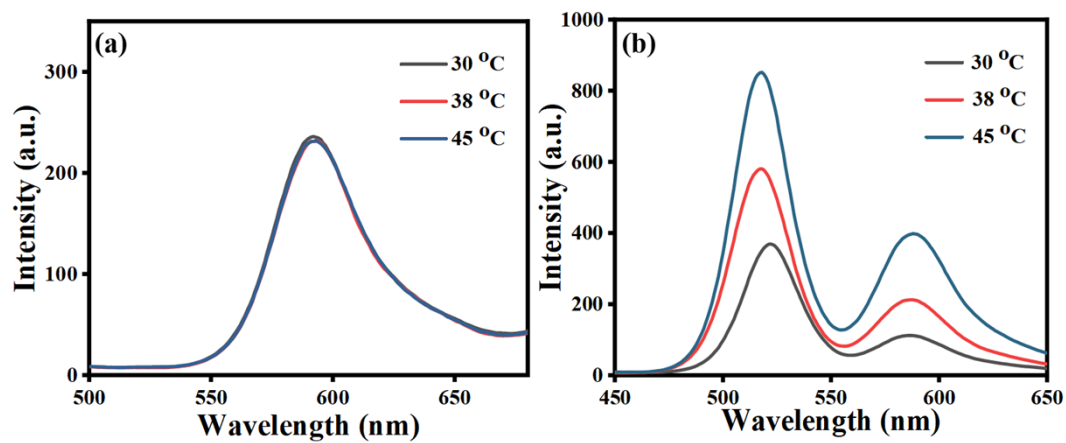


Figure S6. The fluorescence spectra of the (a) RhB@PAN fibers and (b) MAPbBr₃&RhB@PAN fibers with increasing T .

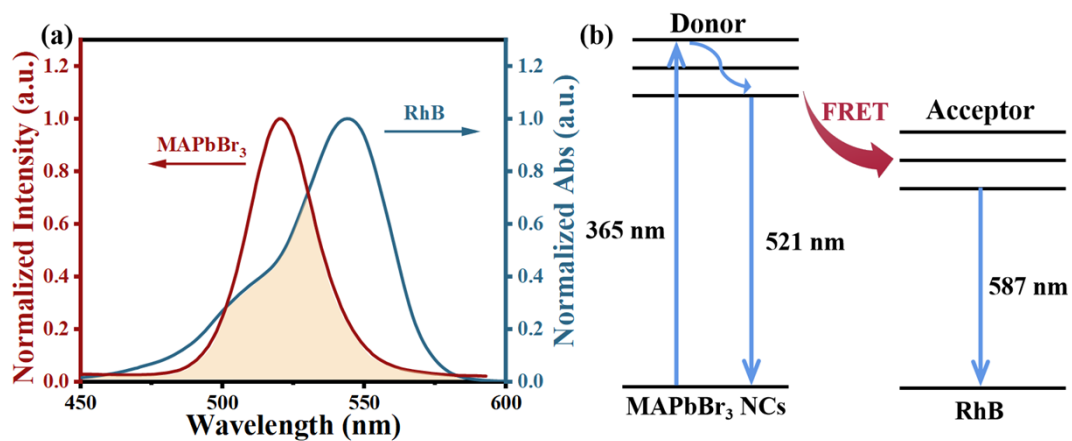


Figure S7. (a) The emission spectrum of MAPbBr₃ (red) and absorption spectrum of RhB (blue). (b) Simplified energy-level diagram of MAPbBr₃&RhB@PAN fibers.