

# Iron-Modified Two-Dimensional Metal–Organic Framework as an “Initiator” for Synthesizing Polypyrrole toward Electrochemical Dopamine Sensing



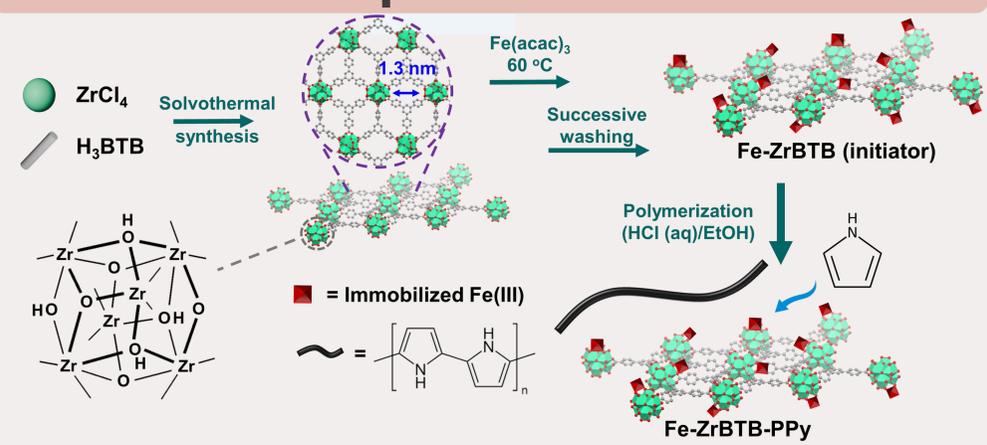
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## Abstract

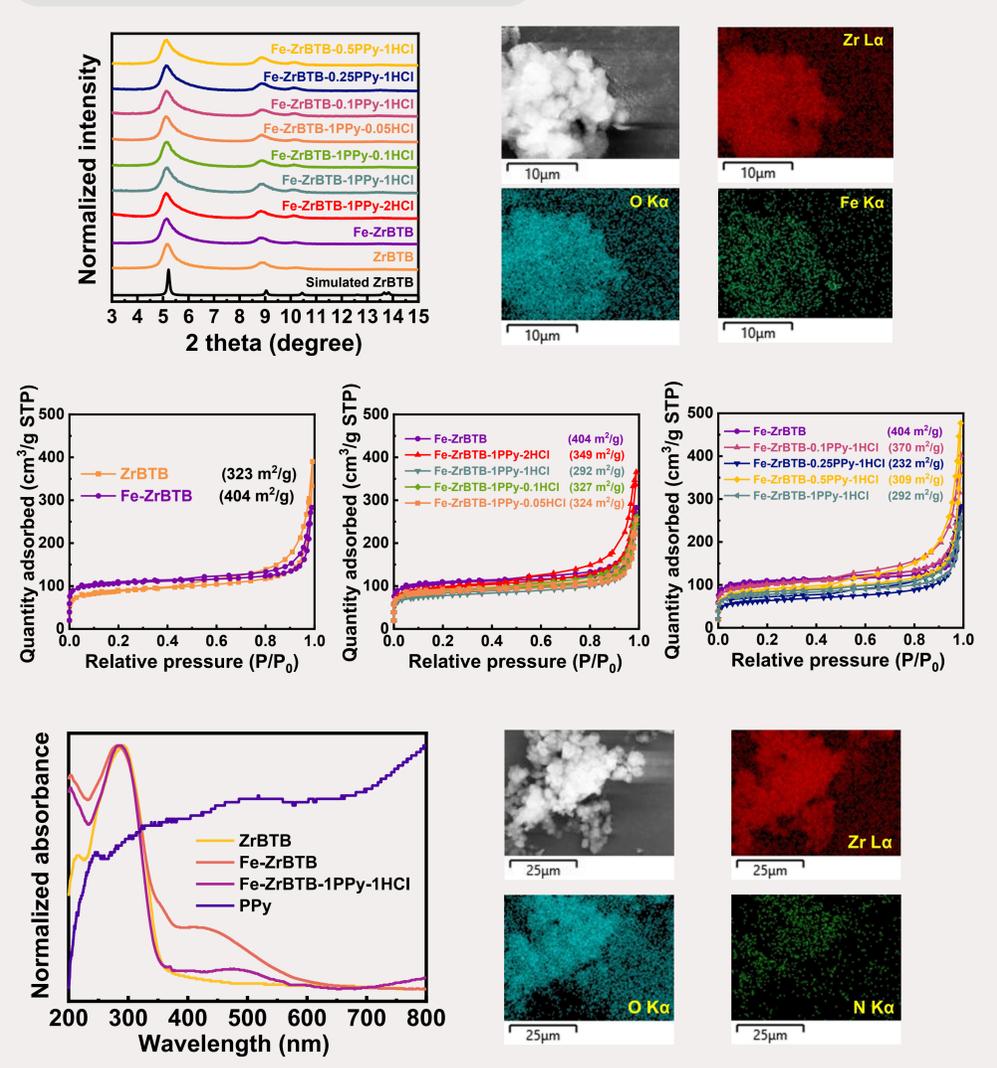
Nanocomposites composed of metal–organic frameworks (MOFs) and conducting polymers have emerged as highly attractive materials for a range of electrochemical applications, and their synthetic processes usually require the addition of an external initiator for polymerization. Herein, **iron(III) sites are post-synthetically modified in a water-stable two-dimensional MOF, ZrBTB (BTB = 1,3,5-tri(4-carboxyphenyl)benzene), and the resulting dispersible MOF sheets are directly utilized as an initiator to polymerize pyrrole in aqueous solutions.** A series of ZrBTB-polypyrrole nanocomposites are thus synthesized, and their crystallinity, morphologies, porosity, and compositions are characterized. All composites are employed as active materials for the electrochemical detection of dopamine in neutral aqueous electrolytes. **With the optimal nanocomposite, a sensitivity of 2725.2  $\mu\text{A}/\text{mM}\cdot\text{cm}^2$ , a linear range of 0–300  $\mu\text{M}$ , and a limit of detection of 0.16  $\mu\text{M}$  can be achieved for sensing DA, which are much better than those achieved by both the pristine polypyrrole synthesized using the soluble initiator and the pristine MOF.** The composite can also selectively detect dopamine in the presence of common interferents including ascorbic acid and uric acid. Findings here shed light on the use of such dispersible porous supports as initiators for polymerization to synthesize a range of conducting polymer-based nanocomposites, which are appealing for diverse applications.

## Experimental

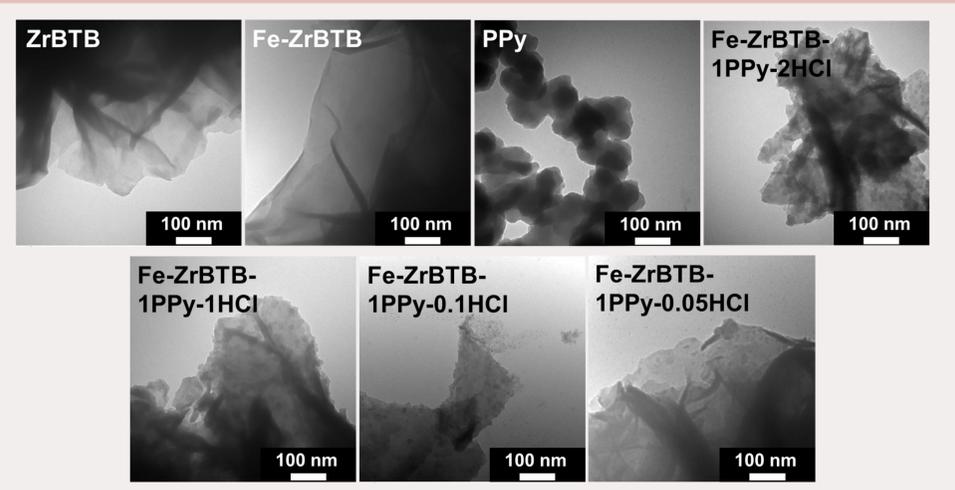


## Results & Discussion

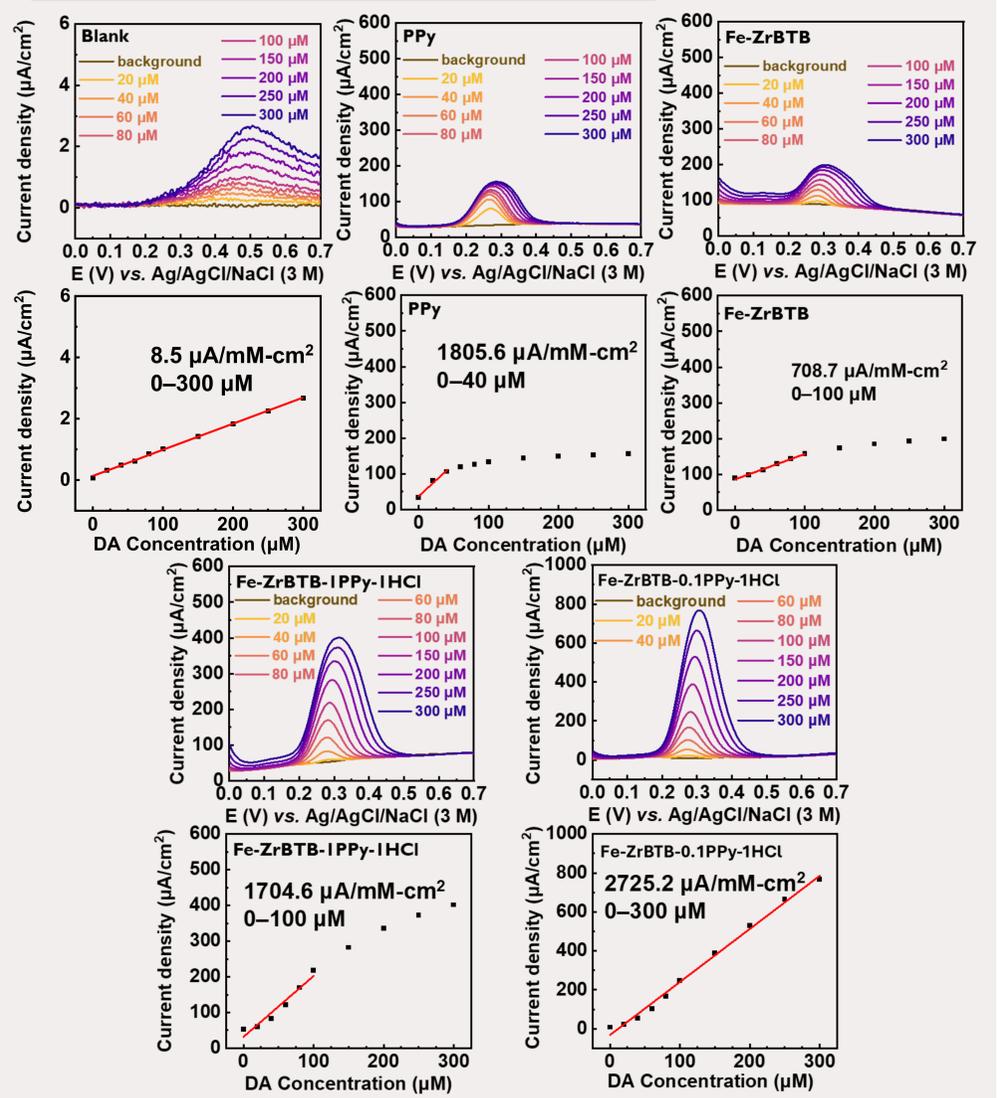
### Material characterizations



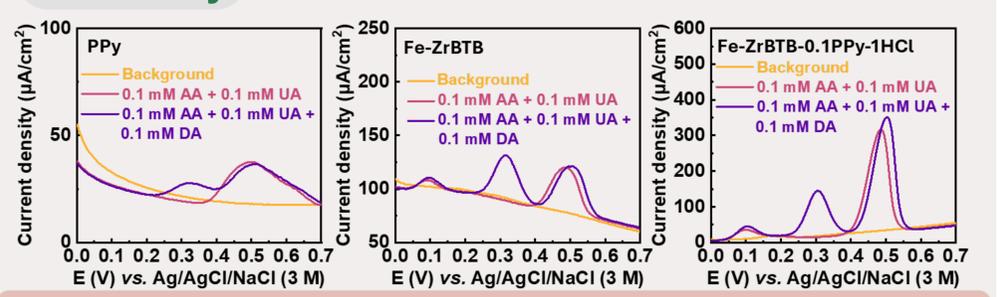
## Results & Discussion



### Electrochemical detection of DA



### Selectivity



## Conclusions

- Ionic iron sites can be uniformly functionalized on 2D nanosheets of a water-stable MOF, ZrBTB, and the resulting Fe-ZrBTB, which can be dispersed as molecular sheets in solutions, can be employed as an initiator to polymerize pyrrole.
- Findings here provide a new route, i.e., serving the functionalized MOF as the initiator for polymerization can yield much smaller nanoparticles of PPy uniformly attached to the surface of 2D MOF sheets.
- By adjusting the amount of HCl aqueous solution or the amount of pyrrole added during the polymerization, the MOF-to-PPy ratio in the obtained composite is tunable and are capable of electrochemically detecting DA in aqueous electrolytes.

