Supplementary Information (SI) for Biomaterials Science.
This journal is © The Royal Society of Chemistry 2026

Supporting information

Coordination driven liquid-to-solid phase transition and self-assembly of DNA-metal condensates

Songtao Zhou[1,2,3,#]; Li Zhang[4,#]; Yuxuan Lin[1,#]; Min Bao[1]; Yongxiu Song[5]; Yunlu Dai[2,3]; Yufeng Pei[1,*]; Jie Song[1,*]*

[1]Hangzhou Institute of Medicine, Chinese Academy of Sciences, Hangzhou 310022, Zhejiang

[2]Cancer Centre and Institute of Translational Medicine, Faculty of Health Sciences, University of Macau, Macau SAR 999078, China

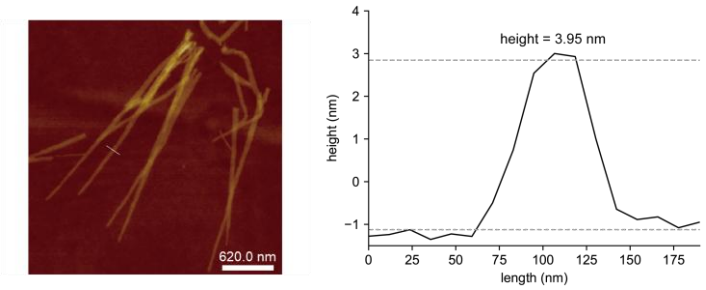
[3]MoE Frontiers Science Center for Precision Oncology, University of Macau, Macau SAR 999078, China

[4]School of Pharmacy, Changzhou University, Changzhou 213164, China.

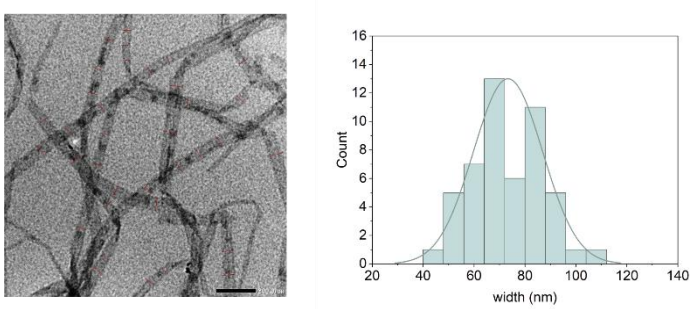
[5]Ningbo institute of Dalian University of Technology, Ningbo 315016, China

Correspondence E-mail: songjie@him.cas.cn

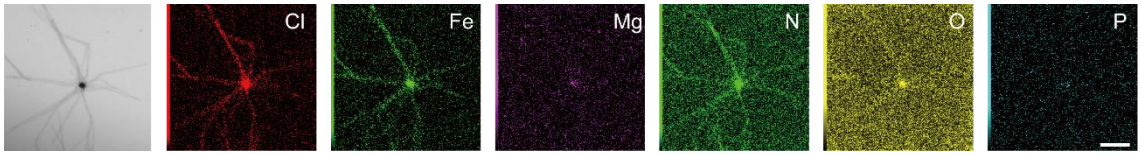
Supplementary figures



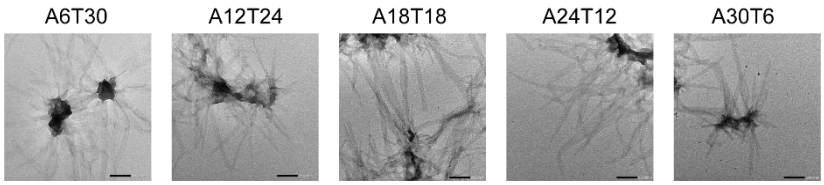
Supplementary Fig. 1. Atomic force microscopy (AFM) images of nanoribbon. The height distribution of samples on the white lines in the left panel is analyzed in the right panel. (scale bar = 620 nm)



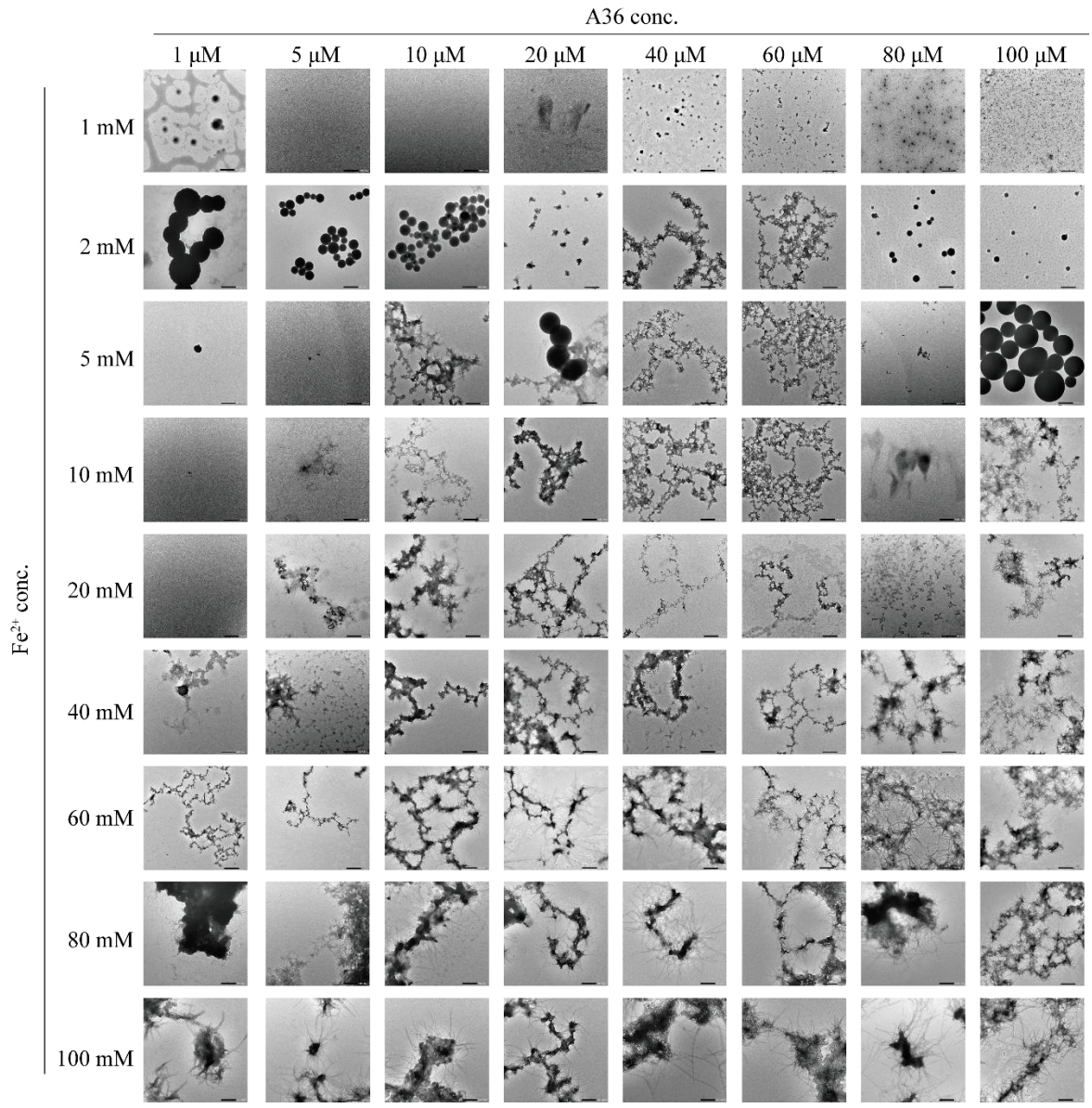
Supplementary Fig. 2. The width distribution of nanoribbons analyzed by FIJI. (scale bar: 200nm)



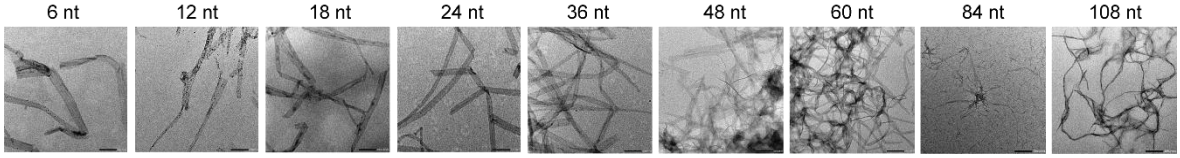
Supplementary Fig. 3. Transmission electron microscopy-energy-dispersive spectroscopy (TEM-EDS) images and the elements distribution in nanoribbon. (scale bar: 500 nm)



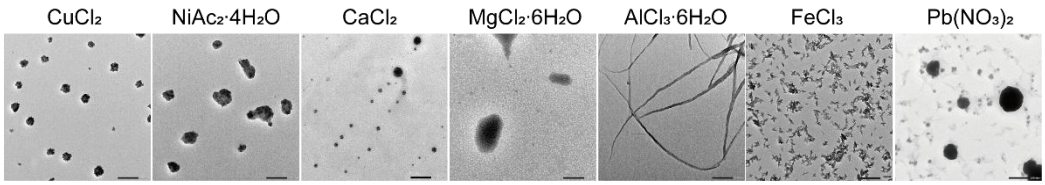
Supplementary Fig. 4. The morphology of blocky sequences of poly-A and poly-T. (scale bar: 200nm)



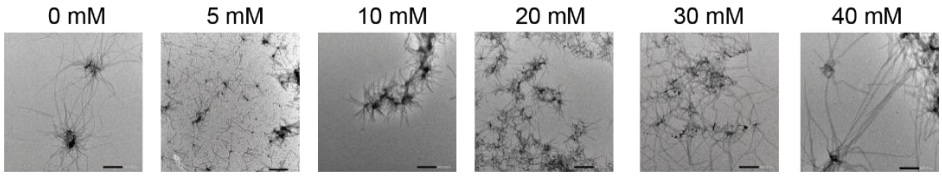
Supplementary Fig. 5. The dual concentration matrix of assembly morphologies for different concentrations of ferrous ions and poly-A. A36 represents poly-A ssDNA with 36 adenine nucleotides. (scale bar: 500nm)



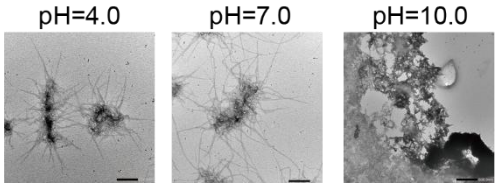
Supplementary Fig. 6. The nano morphologies of different length poly-A. (scale bar: 200 nm)



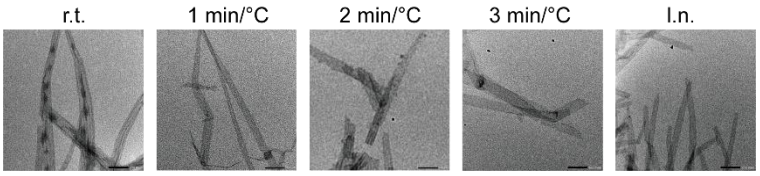
Supplementary Fig. 7. The assembly of poly-A ssDNA and various metal ions.



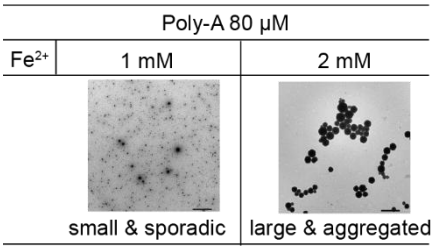
Supplementary Fig. 8. The TEM images of DNA-Fe^{2+} complex under different concentration of Mg2+.



Supplementary Fig. 9. The TEM images of DNA-Fe^{2+} complex formed in different pH. (scale bar: 500 nm)

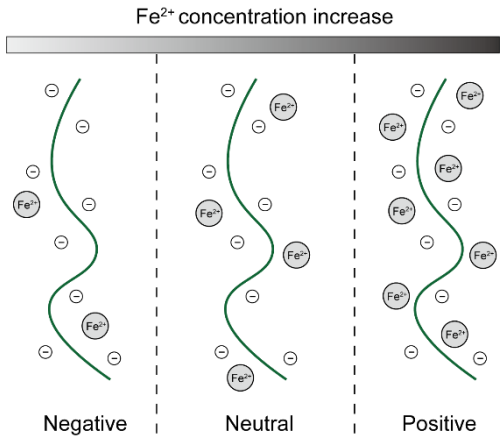


Supplementary Fig. 10. Morphologies under different cooling processes. **r.t.** represent cooling in room temperature; **l.n.** represent fast cooling in liquid nitrogen; other labels are the cooling from 95 °C to 25 °C. (scale bar: 200nm)

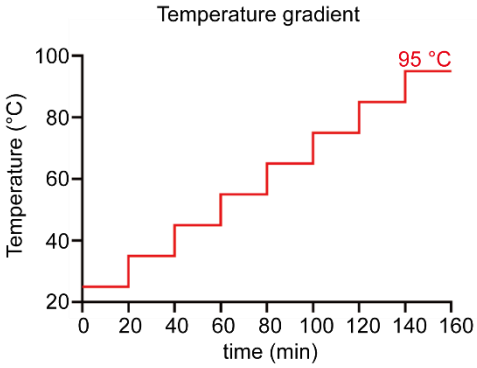


Supplementary Fig. 11. Representative TEM images of nanospheres at different concentrations of

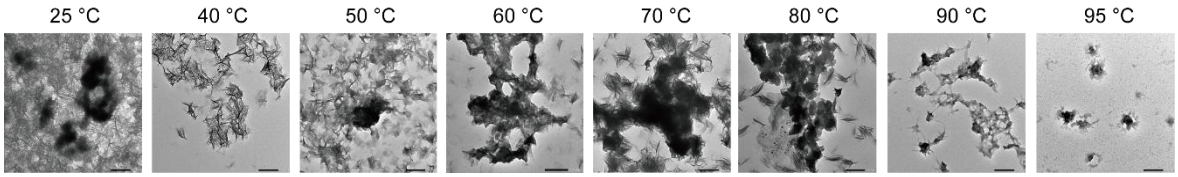
Fe^{2+} (scalebar: 1 μm).



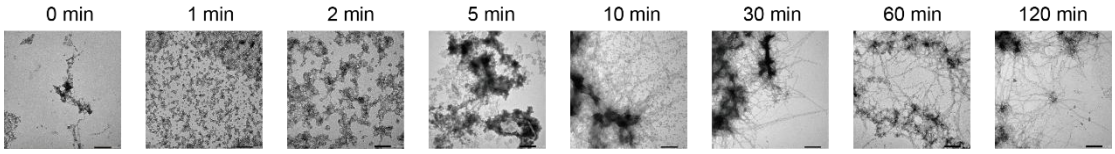
Supplementary Fig. 12. Scheme illustrates the ions adsorption onto DNA under different conditions.



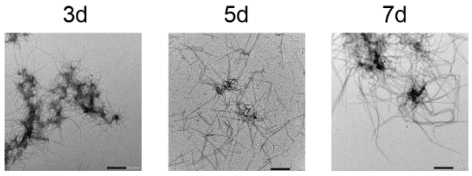
Supplementary Fig. 13. Temperature-time curve during gradient heating. (25-95 °C, 10 min/ 10°C)



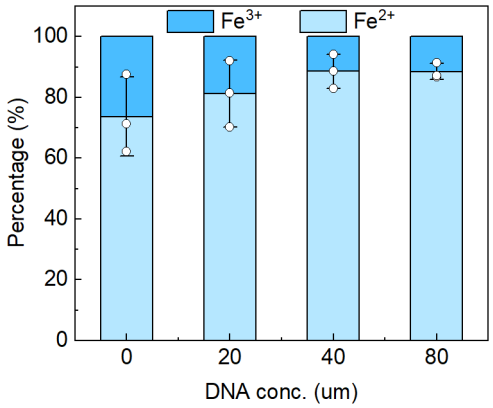
Supplementary Fig. 14. The morphologies evolution of DNA under gradient heating. (scale bar: 200 nm)



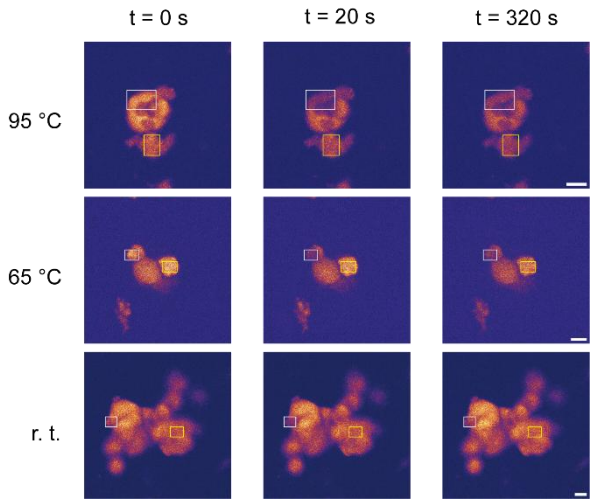
Supplementary Fig. 15. The morphology evolution of DNA-Fe^{2+} complex under different durations of heating treatment. (scale bar: 500 nm)



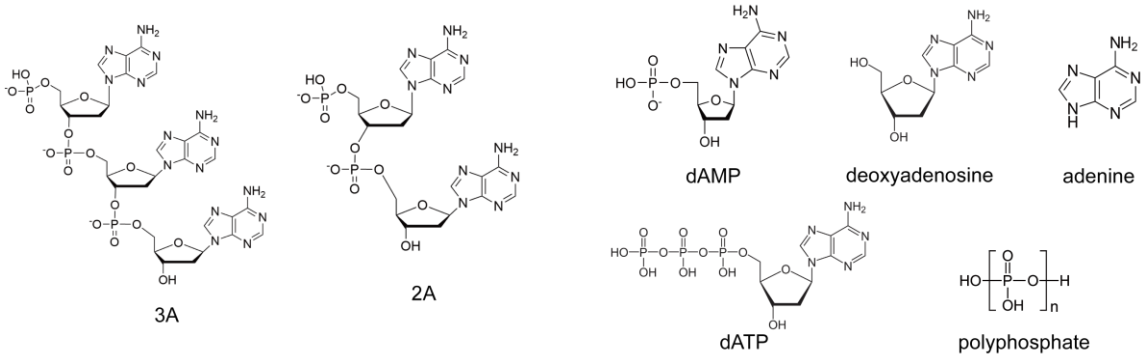
Supplementary Fig. 16. The TEM images of DNA-Fe^{2+} complex after 3, 5, and 7 days. (scale bar: 500 nm)



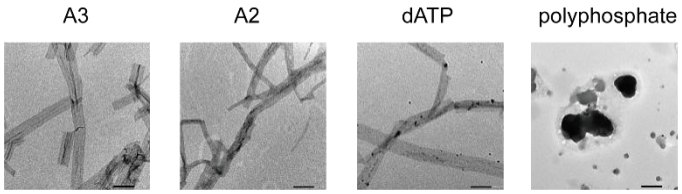
Supplementary Fig. 17. The percentage of Fe^{2+} and Fe^{3+} in Fe-DNA complex. (n=3)



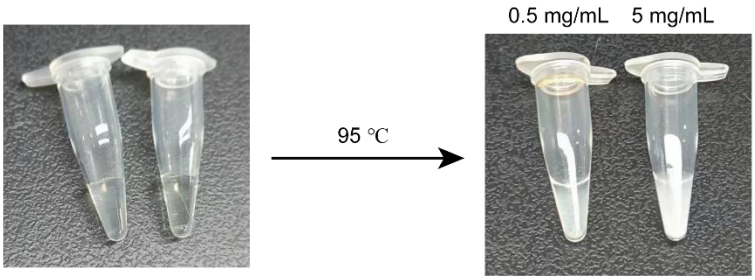
Supplementary Fig. 18. The complete fluorescent images of fluorescence recovery after photobleaching (FRAP) assay. (scale bar: 5 μm)



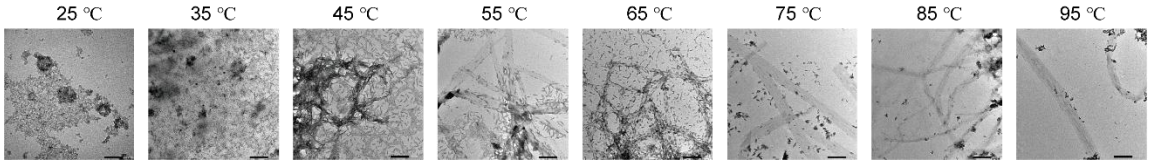
Supplementary Fig. 19. Chemical structure of additional molecules used for self-assembly.



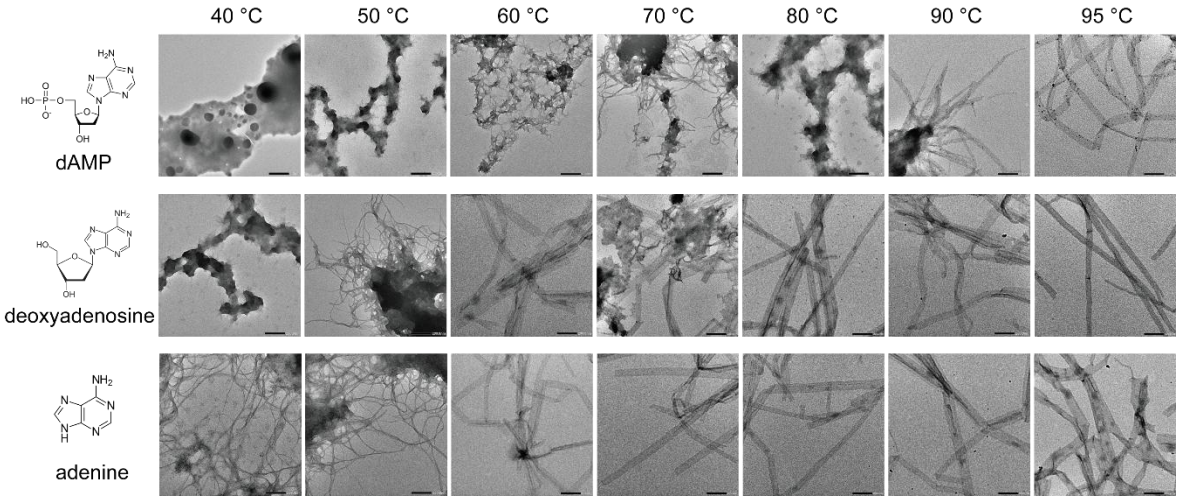
Supplementary Fig. 20. TEM images of additional molecules used for self-assembly. (scale bar:200nm)



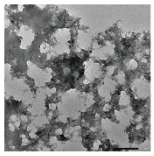
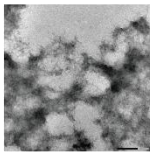
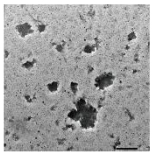
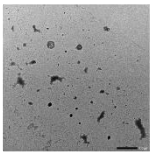
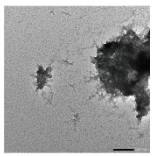
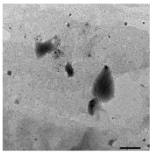
Supplementary Fig. 21. Polyphosphate-Fe^{2+} mixture before and after heating treatment.



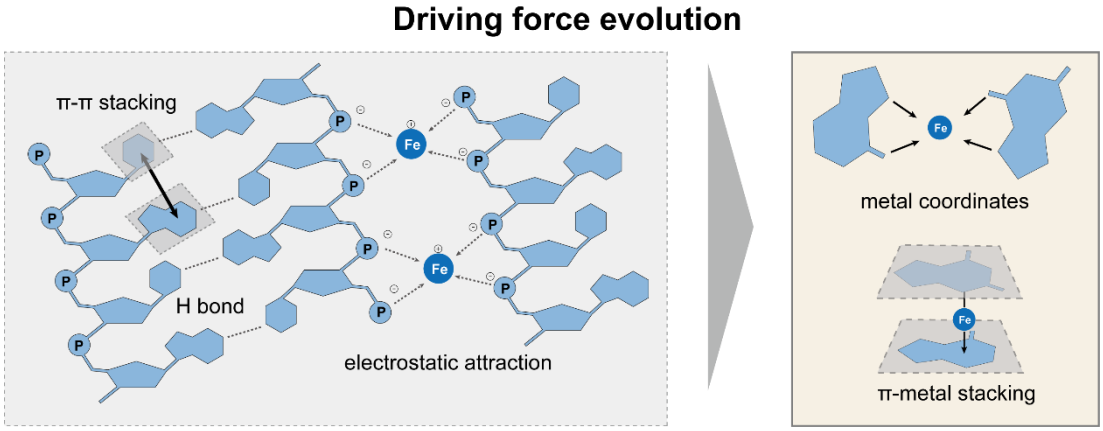
Supplementary Fig. 22. The transformation of adenine-Fe^{2+} clusters under gradient heating. (scale bar: 200 nm)



Supplementary Fig. 23. Nano morphologies of different molecules (dAMP, deoxyadenosine, adenine) under different temperatures (40-95 °C). (scale bar: 200nm)

	urea	formamide	DMSO	EDTA
Pre-incubation				
Post-incubation	NA		NA	

Supplementary Fig. 24. The TEM images show the morphology of DNA-Fe^{2+} complex after incubation with various competitive reagents. (scale bar: 200 nm) **NA**, not available: represent the morphology cannot be characterized in such TEM method.



Supplementary Fig. 25. The illustration shows the driving force evolution under heating.