Double-edged effect of Al(III) ions on amyloid fibrillation of hen egg white lysozyme revealed by Raman spectroscopy

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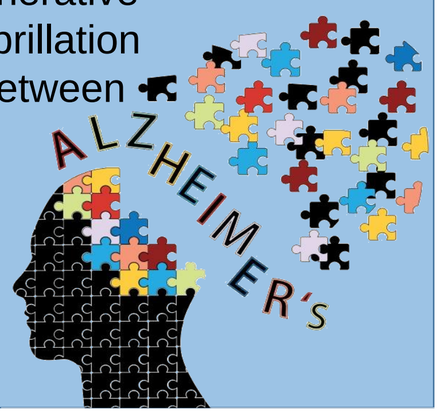
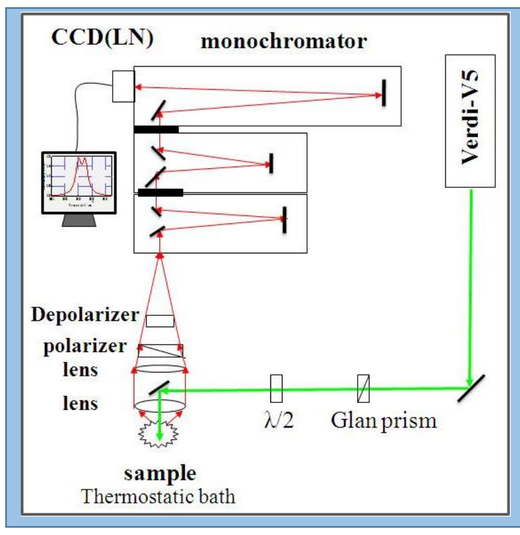
Introduction

Protein fibrillation is a hallmark of neurodegenerative disease. The influence of Al(III) on amyloid fibrillation is significant to understand the relationship between the metal ions and Alzheimer's disease.

Combined method were applied to reveal the mysterious role of Al(III) on formation of HEWL amyloid fibrils.



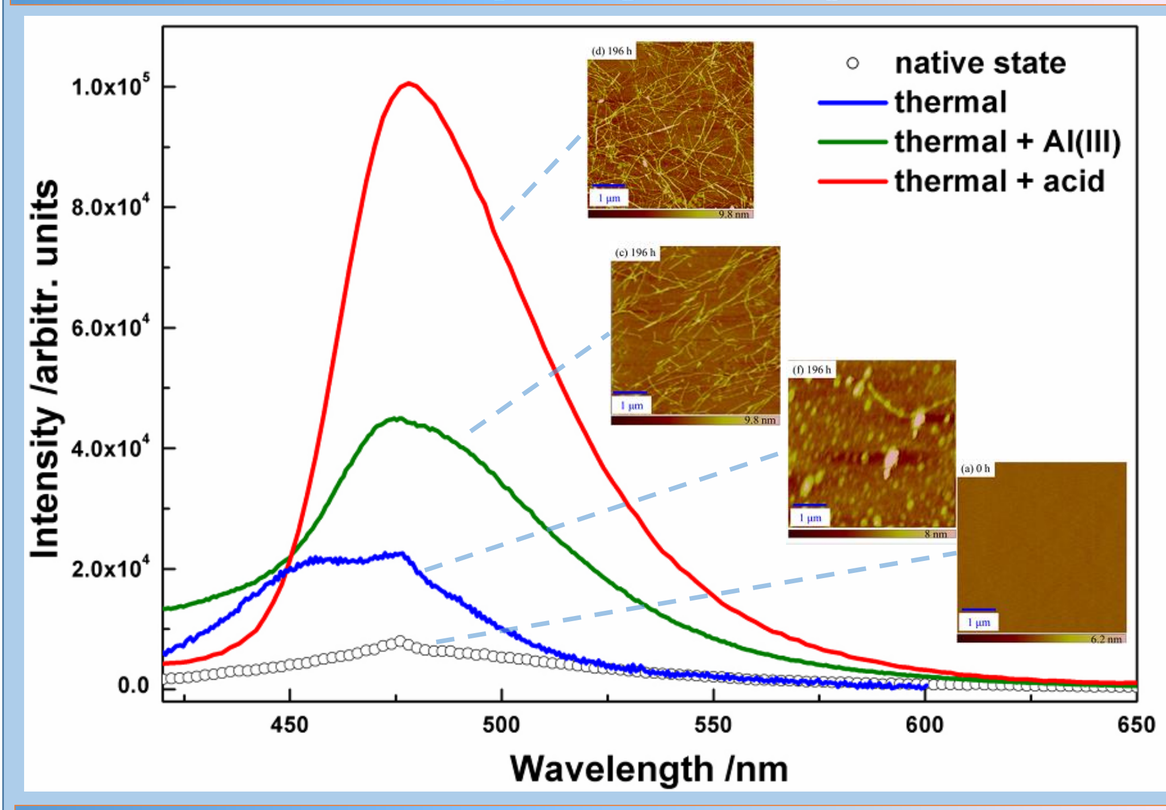
Experimental Method



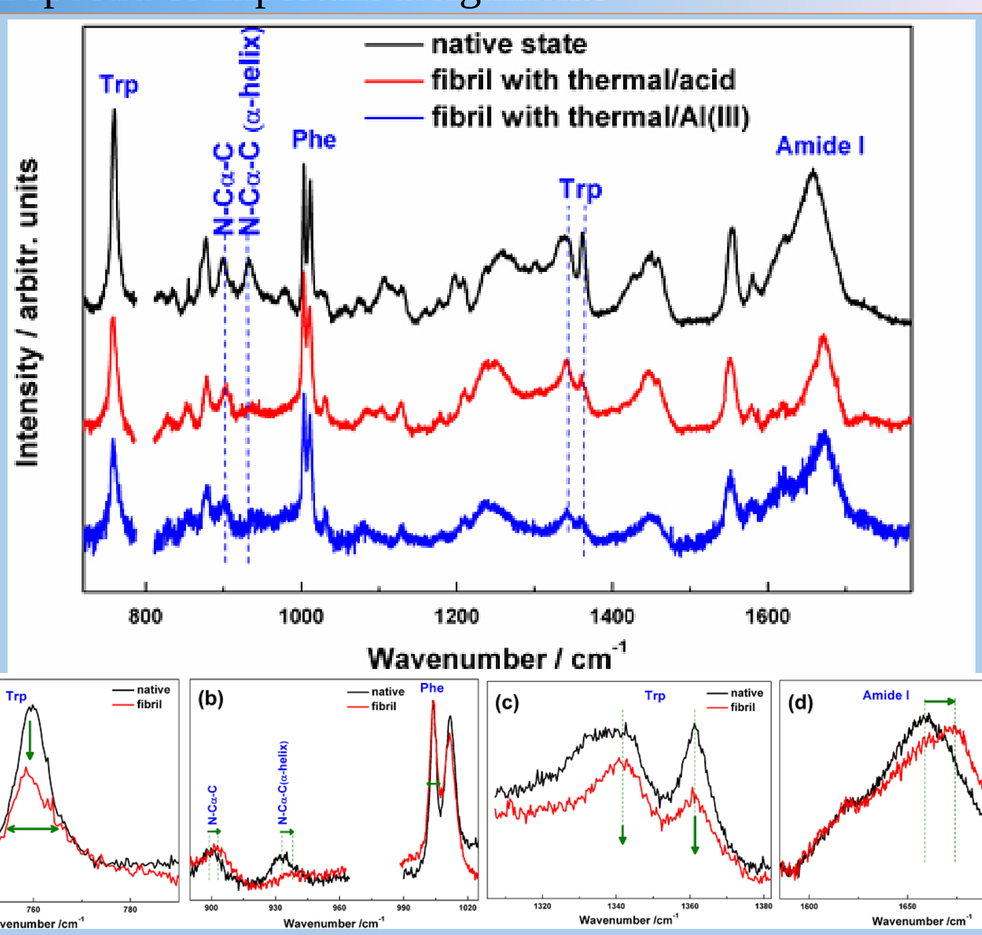
- The Raman spectrometer in the frequency region of 650-1800 cm^{-1} with a spectral resolution of ~1 cm^{-1}
- AFM images for morphologic detection
- ThT fluorescence experiments

Results & Discussion

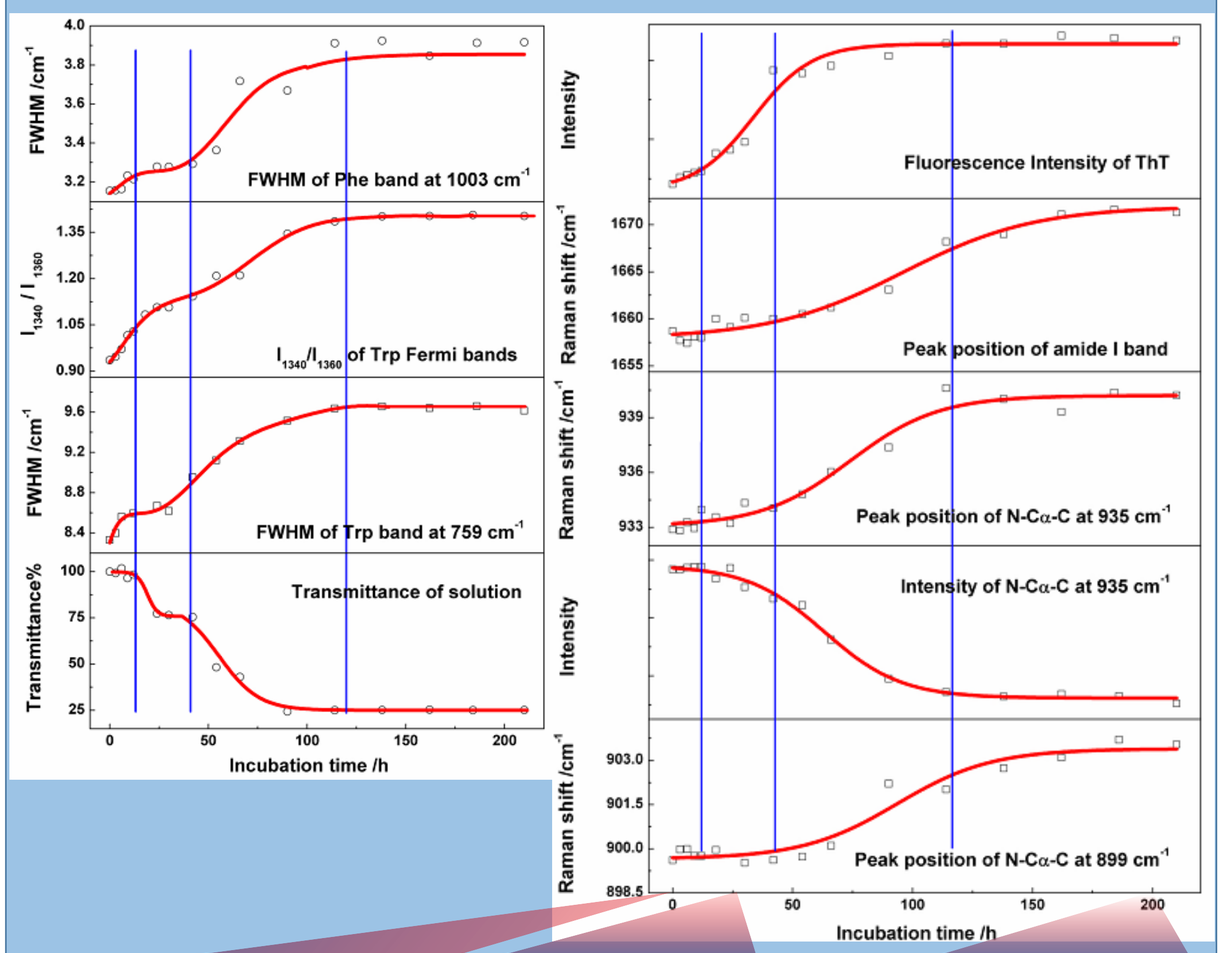
ThT fluorescence & corresponding AFM images

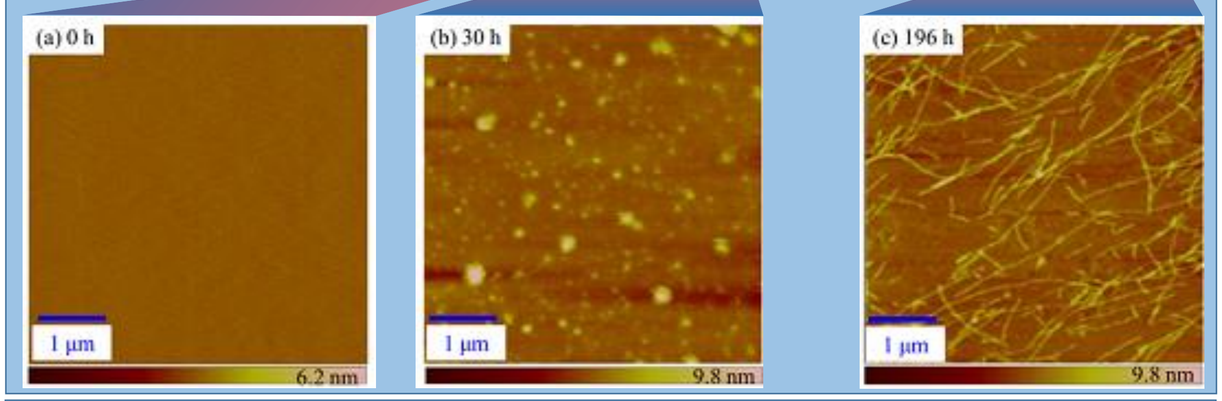


Raman spectra & important assignments

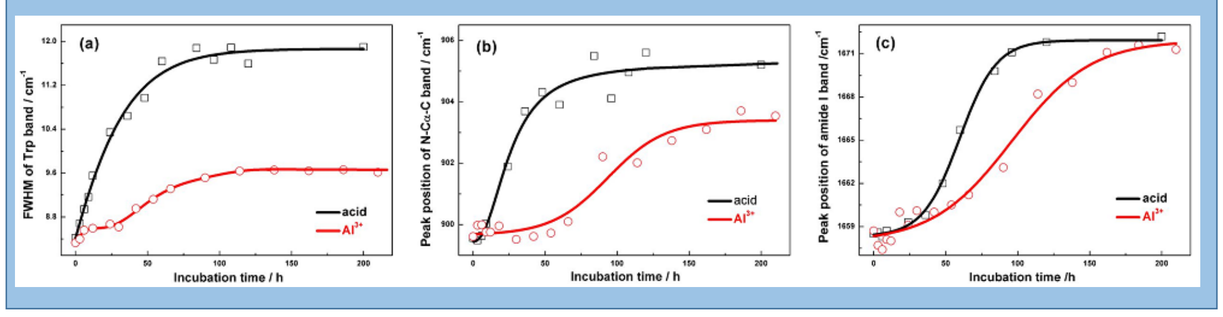


Time-dependence curves of HEWL with thermal/Al(III) treatment

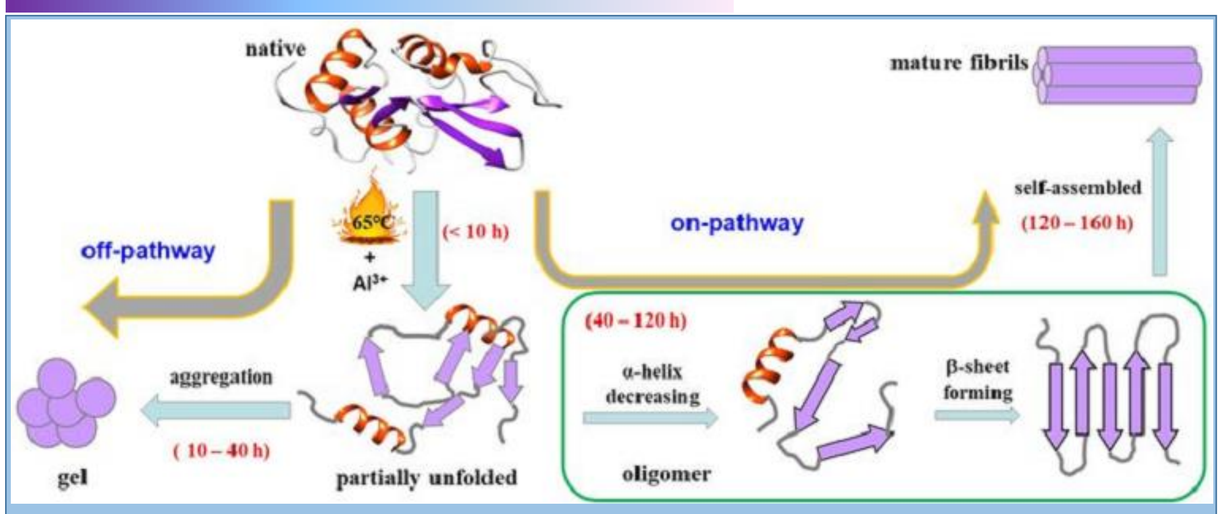




Thermal/Al(III) treatment vs. thermal/acid treatment



Conclusion



◆A four-stage transformation mechanism was proposed to describe the amyloid formation kinetics of lysozyme with thermal/Al(III) treatment.

◆Al(III) ions play a positive role to accelerate amyloid fibrillation of lysozyme, which is, however, weaker than that acid plays.

◆Al(III) ions play as an accelerator to promote the transformation from α-helix to β-sheets directly skipping random coils, which is an inevitable state lysozyme should pass through with thermal/acid treatment.

reference

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[2] L. Xing, K. Lin, X. Zhou, S. Liu, and Y. Luo, *J. Phys. Chem. B* **2016**, 120, 10660

[3] K. Lin, X. Zhou, Y. Luo, and S. Liu, *J. Phys. Chem. B* **2010**, 114, 3567

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