Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Single micelle force microscopy reveals the coordination interaction between catechol and Fe3+. YIRAN LI, YI CAO, WEI WANG, Nanjing Univ — Metal coordination bonds are widely found in natural adhesive, load-bearing, and protective materials, which are thought to be responsible for their high strength and toughness. However, it remains unknown how the metal-ligand complexes could give rise to such superb mechanical properties. Here, combining single molecule force spectroscopy and quantum calculation, we study the mechanical properties of individual catechol-Fe3+ complexes, the key elements accounting for the high toughness and extensibility of byssal threads of marine mussels. We find that catechol-Fe3+ complexes possess a unique combination of mechanical features, including high mechanical stability, fast reformation kinetics, and stoichiometry-dependent mechanics. Therefore, they can serve as sacrificial bonds to efficiently dissipate energy in the material, quickly recover the mechanical properties when load is released, and be responsive to environmental conditions. Our study provides the mechanistic understanding of the coordination bond-mediated mechanical properties of biogenetic materials, and could guide future rational design and regulation of the mechanical properties of synthetic materials.

Yiran Li
Nanjing Univ

Date submitted: 27 Nov 2015 Electronic form version 1.4