Supporting Information

Mussel-inspired Graphene Film with Enhanced Durability as a Macroscale Solid Lubricant

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Supplementary 1 Hydrogen bonding between MAP and Gr

It is well known that MAP interacts with silica surface by forming hydrogen bonding.[1] Therefore, silica substrate was also applied in this study to characterize the MAP/Silica Raman characteristic peaks as comparison. As shown in Figure S1, the spectrum of MAP/Gr showed resemble features as that of MAP/silica spectrum at low wavenumber range 200-800 cm^{-1}. The three peaks at 600-750 cm^{-1} share remarkable similarity to those from the complexation of catechol to Fe^{3+}, but with significantly reduced Raman resonance and shifting toward higher wavenumber. Because the covalent bond is more easily polarizable than the hydrogen bond. Therefore, it is reasonable to conclude, MAP and Gr can interact with each other through hydrogen bonding.

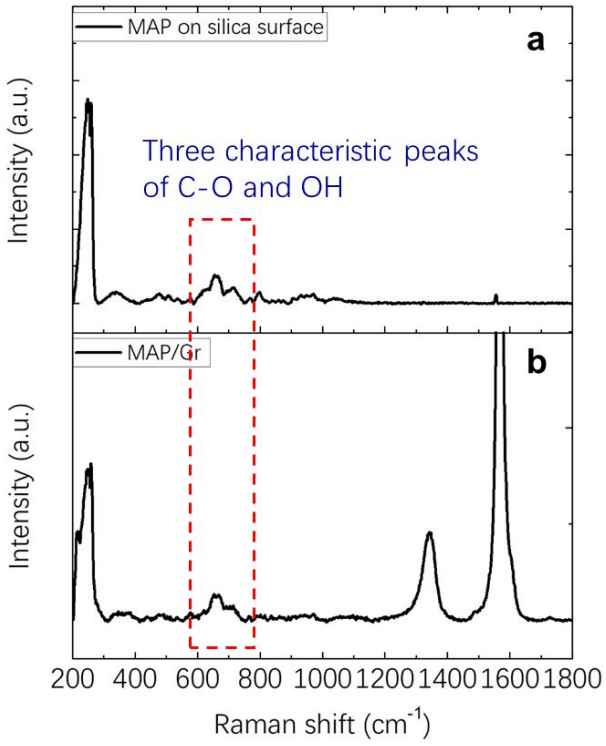

Figure S1. Raman spectrum of (a) MAP on silica surface and (b) graphene/MAP compounds.

Supplementary 2 Wear resistance of Gr and mGr films

The samples in Figure3a were ultrasonic cleaned with ethanol before the measuring of 3D morphologies. With the top-layered mGr film, the carbon steel surface exhibited a specific wear rate reduced by an order of magnitude.

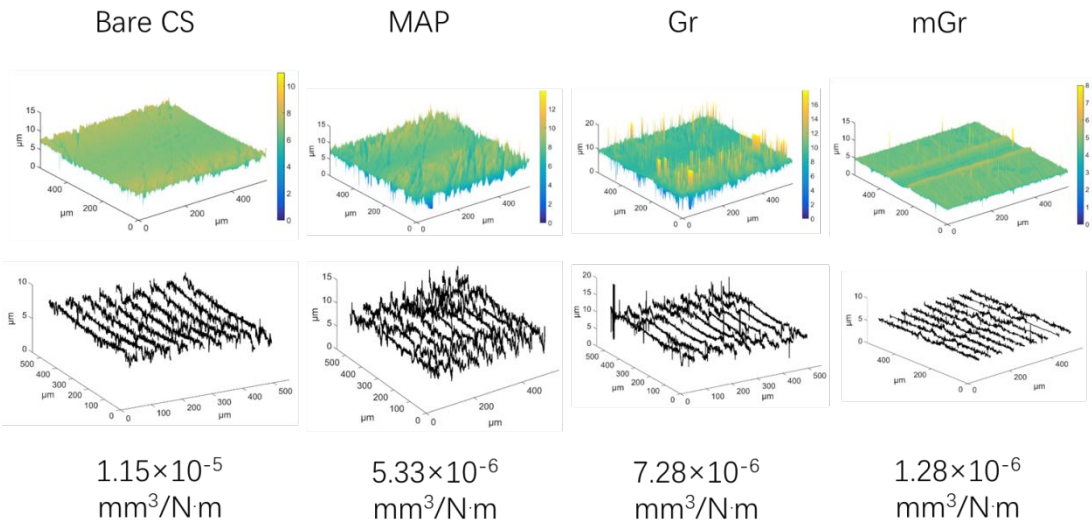

Figure S2 The 3D morphology and 2D profiles obtained from the wear track on the bare carbon steel substrate, MAP layer, Gr film, and mGr film

Supplementary 3 Optical images of the worn surfaces

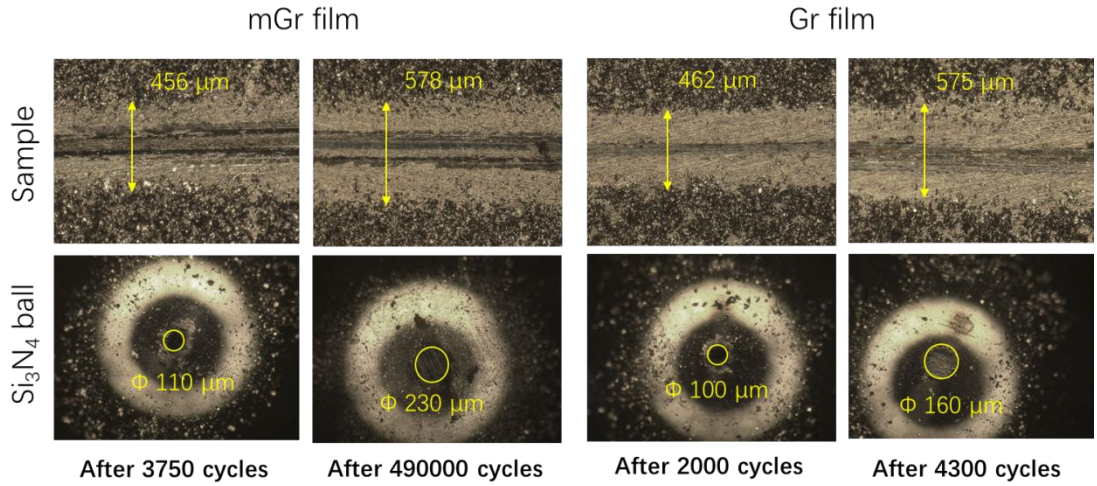

Figure S3 Optical images of the wear tracks on the mGr film, Gr film and the wear scars on their counterpart balls.

References

(1) Mian, S. A.; Khan, Y. The Adhesion Mechanism of Marine Mussel Foot Protein: Adsorption of L-Dopa on α- and β-cristobalite Silica using Density Functional Theory. *J. Chem.* **2017,** 2017, 1-6.