

Supporting Information

Improved mechanical and fatigue properties of graphene

oxide/silica/SBR composites

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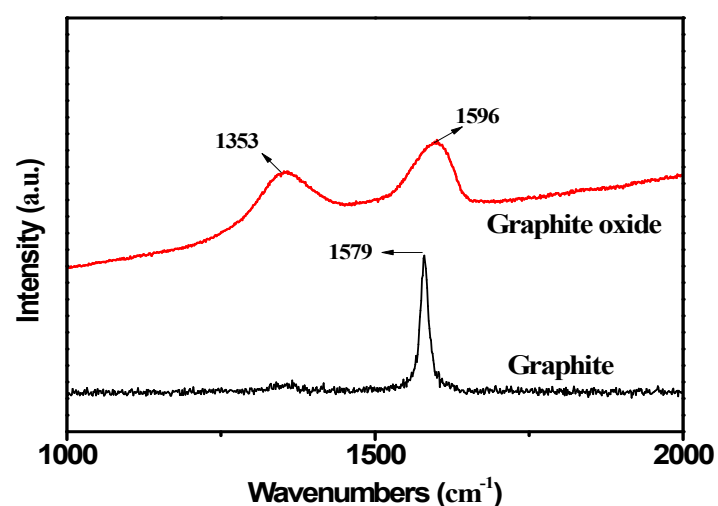


Fig. S1 Raman patterns of graphite and graphene oxide

Raman spectra of graphite (black curve) and graphene oxide (GO, red curve) were performed and shown in Fig. S1. Highly ordered graphite had only a couple of Raman-active bands visible (G-band) in the spectra at 1579 cm⁻¹. The Raman spectrum of GO showed the characteristic G-band at 1596 cm⁻¹ and D-band at 1353 cm⁻¹ respectively. The shift in the G-band towards longer wavenumbers (in comparison with the graphite) confirmed the oxygenation of graphite resulting in the formation of GO with several oxygenated functional groups such as carbonyl, carboxyl, hydroxyl, and epoxy groups.¹

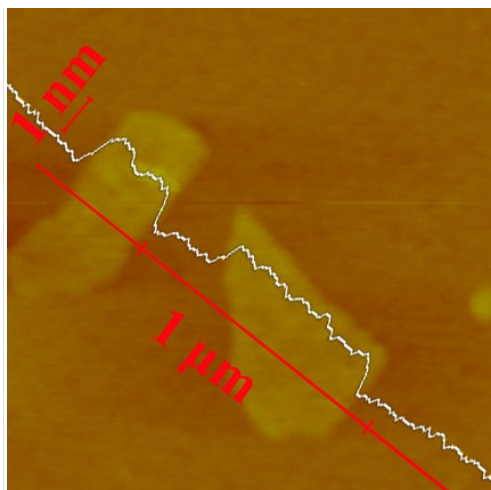


Fig. S2 AFM images of graphene oxide

The thickness and width of GO were measured by atomic force microscope (AFM), as shown in Fig.S2. The thickness and width of GO sheets were about 1 nm and 1 μm , respectively.

Table S1 Information obtained from the image analysis

Sample	No fatigue (Fig.3A)	Fatigue for 20000 cycles (Fig.3B)	Fatigue for 50000 cycles (Fig.3C)
Number of detected silica particles	676	801	882
Total area / nm^2	7258341	7676435	8075221
Average area of particles / nm^2	11315	10080	8237
Area fraction	0.37	0.40	0.42

Notes and references

[1] M.Veerapandian, M.H.Lee, k.Krishnamoorthy, *Carbon*, 2012, **50**, 4228-4238.