Interface/Interphase Study in Epoxy/Graphene-Based Nanocomposites by Combining STEM and EELS

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Abstract

In this work, we quantitatively studied the interphase structures between epoxy matrix and graphene-based nanofillers by using STEM and EELS (See figure 1A and 1B). By analyzing the low energy-loss spectra, we have successfully identified the interphase zone [1,2]. We found a transition layer between polymer matrix and nanofillers, where the density changes gradually (See figure 1C and 1D). The density of the GNPs/epoxy interphase has been found to be 2.89% higher compared with that of the epoxy matrix (See figure 1E). However, the density of the GO/epoxy interphase has decreased by 1.37% compared with the epoxy matrix (See figure 1F). While many oxygen-containing groups were introduced onto the graphene surface after oxidation, the intrinsic properties of graphene sheets have been decreased largely. This work gives an understanding of the interphase of carbon-based composites and also provides an indication for the effects of the modification of nanofillers. A better interaction between the nanofillers and the matrix in the interface leads to efficient energy transfers; while the excellent properties of nanofillers should be maintained. Those two aspects should be considered in fabricating polymer matrix composites.

References

[1] Ferrari, A. C *et al*, Phys. Rev. B 621(2000), 11089-11103.
[2] Egerton, R. F. Springer Science & Business Media (2011), 306-333.

Figures

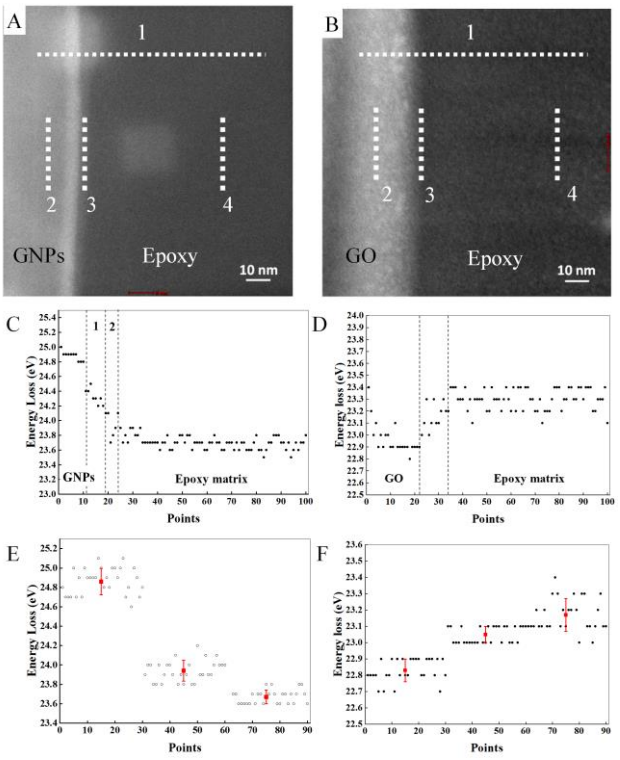

Figure 1: High magnification STEM Z-contrast images of (A) GNPs/Epoxy and (B) GO/Epoxy interface; the white lines marked out by numbers represent the low-energy loss acquisition position; (C) and (D): the peak positions extracted from the low energy-loss spectra acquired from line 1 in (A) and (B), respectively; (E) and (F): the peak positions extracted from the low energy-loss spectra acquired from line 2, 3 and 4 in (A) and (B), respectively.