Water sorption and diffusion in (reduced) graphene oxide-alginate biopolymer nanocomposites

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Supporting Information

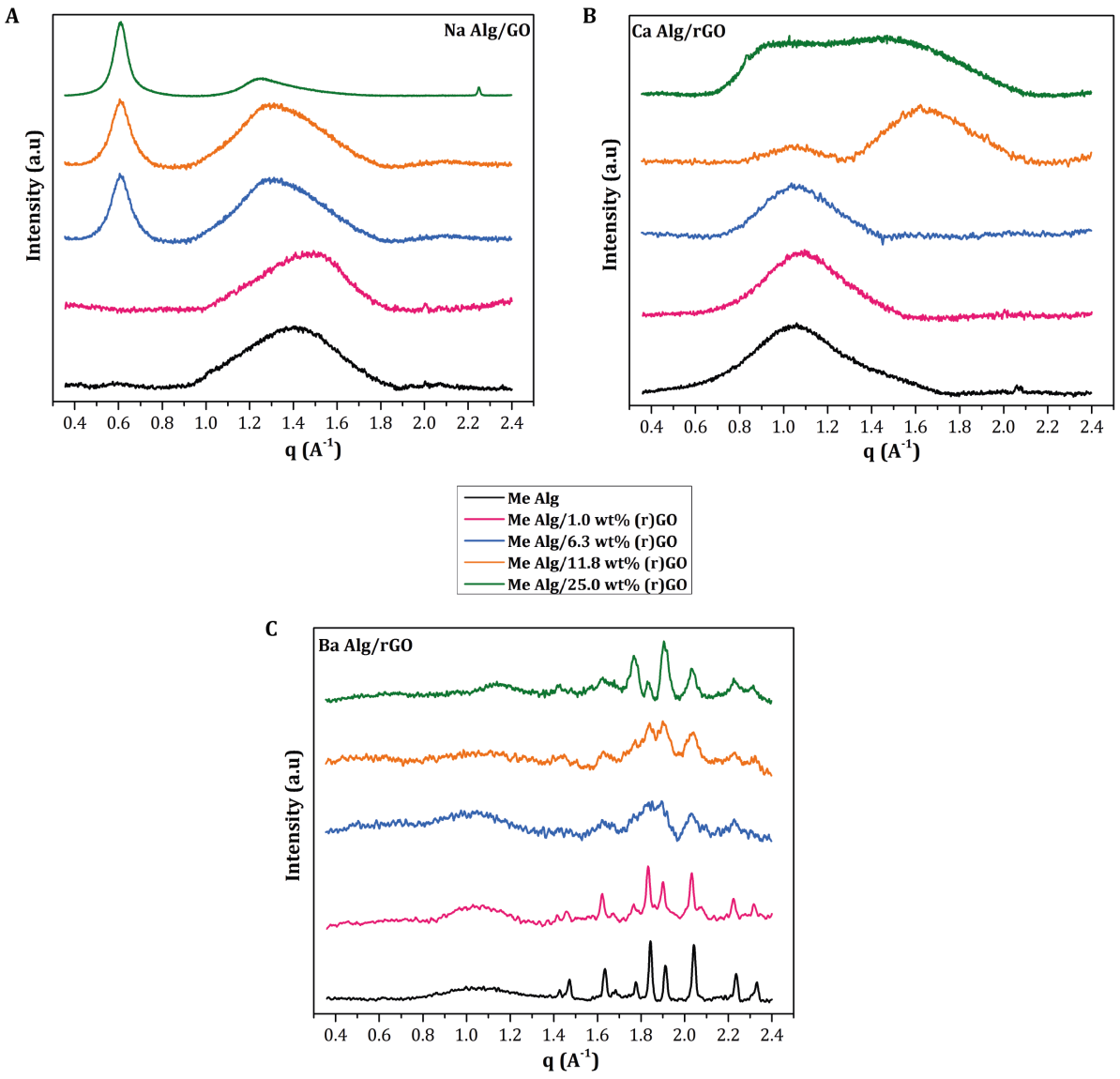

Figure S1. X-ray scattering patterns of (A) Na-Alg/GO composite films, (B) Ca-Alg/rGO composite films, and (C) Ba-Alg/rGO composite films. The spectra were collected in the Bragg-Brentano reflection configuration, normalized and shifted upwards.

Figure S1 illustrates X-ray scattering patterns of (reduced) graphene oxide-alginate composite samples. As illustrated in Figure S1 (A), with increasing GO concentration, the peak at about 0.6 A^{-1}, corresponding to the interlayer spacing between GO sheets of approximately 11 Å, becomes more prominent. The broad peak at 1.4 A^{-1} corresponds to an amorphous structure of Sodium alginate with the average 4.5 Å distance between the polymer chains. With increasing GO concentration, the average spacing between the neighboring polymer chains increases to 5.2 Å, which suggests intercalation of GO sheets between the polymer chains. As shown in Figure S1 (B), upon cross-linking alginate with Calcium ions, the interlayer spacing between the adjacent polymer chains increased to approximately 6.3 Å, the value previously reported by other authors [1]. With increasing amount of rGO, the new peak at about 1.7 A^{-1} begins to evolve corresponding to the interlayer spacing between rGO sheets of 3.7 Å [2]. In addition, the original polymer peak shifts to higher interlayer spacings with increasing weight fraction of rGO and merges with that of rGO. Barium alginate and its rGO composites, on the other hand, possess a completely different microstructure. The unfilled polymer exhibits a semi-crystalline structure that begins to evolve to quasi-crystalline structure in the presence of rGO. We refer our readers to a more detailed discussion on the formation of the incommensurately modulated structure of Ba-Alg/rGO composites in our recent publication [3].

References

1. Li, L. B.; Fang, Y. P.; Vreeker, R.; Appelqvist, I.; Mendes, E. *Biomacromolecules* **2007,** *8* (2), 464-468.

2. Park, S.; An, J.; Potts, J. R.; Velamakanni, A.; Murali, S.; Ruoff, R. S. *Carbon* **2011,** *49* (9), 3019-3023.

3. Vilcinskas, K.; Norder, B.; Goubitz, K.; Mulder, F. M.; Koper, G. J. M.; Picken, S. J. *Macromolecules* **2015,** *48* (22), 8323-8330.