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EDITORIAL

Chemically Modified Graphenes

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This themed issue of the *Journal of Materials Chemistry* has as its focus the chemistry of graphene. It seems to me to have been a relatively short time since the Editor of *Nature Nanotechnology* requested a *News and Views* article from me about what at least some implications of chemistry of graphene might be.[1] The quality and breadth of articles presented here in this themed issue show that the chemistry of graphene is attracting attention, both because of growing fundamental interest in reaction mechanisms, as well as a route to new materials. I recall attending a lecture by Jack Fischer of the University of Pennsylvania many years ago, in which he referred to carbon nanotubes as a "fourth state of matter" because an individual CNT could itself be considered as a crystal, just as an aggregate of closest packed identical CNTs was also a crystal. To the physicist with an interest in 2-dimensional electron gas physics or its utility for electronic devices, graphene has a particular meaning, just as to the chemist and materials scientist interested in, say, generating new materials through chemistry, it can be considered as a novel macromolecule with which to generate new chemical products and materials.

Based on conversations with synthetic chemists I am beginning to realize that this novel macromolecule poses fascinating fundamental issues that we do not yet have answers for. How will synthetic chemists who primarily learn and study about reaction mechanisms in terms of the chemistry of small molecules, begin to develop an understanding of the detailed chemical reaction pathways when graphene, typically present as a very large macromolecule, is one of the reactants?

Do we now have a fundamental understanding of, *e.g.*, how graphene nucleates, how islands then grow, and how such islands eventually merge to form a complete monolayer film on copper foils by chemical vapor deposition? I think it fair to say that more research is needed to understand such issues as well as of chemistry of graphene and related materials such as graphene oxide, and that the papers presented here are important steps to achieving such deeper understanding. This themed issue should attract the attention not only of scientists currently doing research on graphene, but also of synthetic chemists that might in the future contribute new routes to synthesizing or functionalizing graphene, and of scientists and technologists who will ponder what chemical functionalization of graphene means in terms of new properties and possibilities for applications.

I thus suggest that the six *Feature articles* that review different aspects, the several articles that *highlight* recent advances, and the many papers and communications that report new results of the chemistry of graphene, should garner widespread interest.

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Reference

1 Rod Ruoff, *Nature Nanotechnology*, 2008, **3** (1), 10–11.