Enhanced Thermal Oxidation Stability of Reduced Graphene Oxide by Nitrogen Doping.

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Nitrogen-doped reduced graphene oxide (N-doped RGO) samples with a high level of doping, up to 13 wt. %, have been prepared by annealing graphene oxide[1] under a flow of pure ammonia gas. The reaction of GO with NH_3 was investigated at different temperatures (500–800 ºC), treatment times (10-300 min, including different heating programs), and flow rates of ammonia (between 60 and 600 $mLmin^{-1}$). Samples with different nitrogen contents have been characterized by scanning electron microscopy, elemental and thermogravimetric analysis and X-ray photoelectron spectroscopy. The presence of nitrogen within the structure of RGO induces a remarkable increase in the thermal stability against oxidation by air.[2] The thermal stability is closely related with the temperature of synthesis and the nitrogen content. The combustion reaction of nitrogen in different coordination environments (pyridinic, pyrrolic, and graphitic) is analyzed against a graphene fragment (undoped) from a thermodynamic point of view. In agreement with the experimental observations, the combustion of undoped graphene turns out to be more spontaneous than when nitrogen atoms are present. This work opens up new possibilities for tailoring the properties of graphene and related systems, further expanding their range of application, for instance in synthesis of reinforcing material in components exposed at elevated temperatures and friction, and to prepare catalysts with applications in fuel cells.[3]

References

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