Hydrazine-reduction of graphene oxide in DMF-water system: The effect of temperature on the dispersibility and the electrical conductivity of highly reduced graphene oxide

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Many of graphene applications require dispersion of graphene, or chemically converted graphene, in solvents. A method for the converting hydrophilic graphene oxide (G-O) to hydrophobic CCG suspension is essential for obtaining high quality HRG for applications. We report the conversion from hydrophilic graphene oxide to hydrophobic highly reduced graphene oxide (HRG) using hydrazine reduction in DMF-water system. The level of hydrazine reduction of graphene oxide was slightly increased with increasing temperature. In the opposite extent of reduction, the dispersibility of resultant HRGs in organic solvents clearly decreased by increasing reduction temperature. Reduction in primarily organic media, together with the low temperature is the key factor to prevent irreversible agglomeration or multilayers aggregate during reduction process. The dispersibility of HRG was as high as 0.97 mg/mL in DMF and the electrical conductivity of HRG free-standing paper was 22,000 S/m when reduced for 24 h at 40 0C, the highest electrical conductivity ever reported for a chemically-reduced graphene oxide.