Engineering Graphene Oxide Surface Chemistry and investigation of corresponding physicochemical properties

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Defect density in the graphite lattice increases with the ball-milling time is a very well-studied phenomenon. Guided by this, our hypothesis was that the oxygen content of graphite can be substantially enhanced by oxidizing ball-milled graphite and the oxygen content would monotonically increase with the milling time as the defect sites would be preferred sites for oxidation and eventually saturate for GO prepared from graphite with high ball-milling time. Surprisingly, our observations unfurled that this correlation was not directly proportional for all milling hours. Even though, the defect density monotonically increased with milling time the oxygen content initially increased and then decreased. We have tried to explain the predominant phenomenon behind this observation. We have been able to develop a methodology for synergistically tuning the total oxygen content, relative abundance of different oxygen moieties and size of GO sheets. This holds enormous importance in practical applications of GO. The study further provides insight into the variation of various physicochemical properties of GO along the synthesized GO series.