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Study of Safer Storage and Handling of Graphite Oxide

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Abstract

Due to the immense potential of graphene for energy storage and composite filler applications the large-scale production of graphene is of increasing commercial and academic interest. The existing direct methods of large-scale graphene production are not economical using current technology. Therefore, an alternate synthesis route to produce graphene-like material involving graphite oxide (GO) is pre-dominantly used. This method involves the oxidation of graphite to GO and its subsequent reduction to reduced graphene oxide (rGO). The proposed method has shown potential for bulk production at high yield. However, prior studies have shown that GO can undergo explosive decomposition under certain conditions. There is no documented process safety incident specifically related to GO so far but GO is an energetic material that can undergo explosive thermal reduction, A number of unanticipated process incidents have occurred due to inadequate study and understanding of energetic materials stored in large quantities. As research is moving towards large scale manufacturing of GO, the motivation of this research is to investigate potential process safety issues with bulk GO storage and handling. Specifically, we examine the underlying causes of explosive behavior of bulk GO and propose safer storage and handling conditions. Additional studies are conducted in an Advanced Reactive System Screen Tool (ARSST) calorimeter to understand the effect of storage temperature, impurities, pH, and process conditions. This research will be beneficial in assessing the hazards of GO and enhancing safety of rGO production processes over their life cycles.

Keywords: *Bulk graphite oxide, ARSST, energetic material, thermal hazard, nanomaterials*