# Abstract

Two dimensional (2D) materials have been seeking immense interest from a wide range of researchers across diverse domains. This is on account of their quasi-planarity, which imparts remarkable mechanical, chemical, and optical properties to the nanomaterials of this family. Layered metal borides represent one such family of ionic layered materials in which metal atoms are sandwiched in between boron honeycomb planes. These layered crystals present rich prospects to access the inherent graphenic forms of boron upon delamination. We have recently demonstrated that it is indeed possible to exfoliate layered magnesium diboride ($MgB_2$) by selectively extracting the inter-layer Mg atoms using the chelating action of disodium salt of ethylenediamine tetraacetic acid ($Na_2EDTA$). One important limitation of the exfoliation assisted by $Na_2EDTA$ is a relatively low yield (~7%) of the method. Here we present that rational choice of chelating agents with a higher affinity towards the interlayer Mg atoms and suitable tuning of the pH of the chemical milieu, enabled an increase in the yield of nanosheets (up to ~87%). The high yield exfoliation process resulted in aqueous dispersions of chemically modified boron based nanosheets which were characterized for their morphological details (FESEM, TEM and AFM), optical properties (UV-Vis spectroscopy), surface charge (Zeta potential) and chemical make-up (EDX, FTIR, and XPS spectroscopy). The high yield of these nanosheets derived from $MgB_2$ in the form of processable aqueous dispersions, enables their utilization as inorganic fillers in making nanocomposites with polyvinyl alcohol (PVA). Our initial studies have shown the effect of nanosheets on the thermal and mechanical properties of the PVA nanocomposite (PNC), analyzed by various characterization techniques. It was found that thermal conductivity of PNC gets enhanced as compared to neat PVA. Further, thermal stability and glass transition temperature of PNC are improved, suggesting a good interaction of nanosheets with the polymer, whereas the mechanical properties decrease with increasing filler content. This points to a need for improvement in the synthesis method of PNC so that we can utilize the full potential of these nanosheets as reinforcing agents. This study opens up avenues for directly employing boron based nanosheets as nano-fillers in polymer composites to tap the remarkable thermal, mechanical, optical, and chemical properties of nanoscaled metal borides.