

# Facile Fabrication of Plant Extract Modified Boron Nitride Nanosheets and Improved Mechanical Properties of Polyurethane <sup>†</sup>

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**Abstract:** In this work, we prepared multifunctional h-boron nitride nanosheets (h-BNNs) using three plant extracts, namely *Panax ginseng*, *Morus nigra*, and *Hovenia dulcis* via ultrasound-assisted exfoliation of boron nitride. The green synthesized h-BNNs were characterized with X-ray diffraction, transmission electron microscopy (TEM), Fourier transformed infrared spectroscopy, scanning electron microscopy, energy-dispersive X-ray spectroscopy, and X-ray photoelectron spectroscopies. TEM analysis confirmed the transparent h-BNNs with an average lateral dimension of 77 nm. The existence of several layers in h-BNNs could be seen in AFM analysis. The synthesized h-BNNs were blended with castor oil-based polyurethane (PU) to yield h-BNNs/PU nanocomposites with good dispersion of phyto-functionalized h-BNNs. The inclusion of phyto-functionalized h-BNNs could improve the mechanical properties of PU composites. The ultimate tensile strength for pure PU was 7.33 MPa and reached 10.1 MPa for the PU/h-BNNs composite. The elongation at break for pure PU was found to be 94%, which increased to 152% after adding 0.5% h-BNNs to the PU composite, indicating an improvement in the ductility of the PU composite with the integration of h-BNNs flakes. The facile functionalized approach of phytochemical functionalized h-BNNs paves the way for promising applications of h-BNNs in the development of strong polymer materials.

**Keywords:** boron nitride nanosheets; plant extract; ultrasonication; mechanical property; polyurethane.

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## Conflicts of Interest

The authors declare no conflict of interest.