Boron Nitride Nanosheets As New Barrier Additive For Plastic Packaging

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NEW/NANO MATERIALS

Two-dimensional Nano-platelets as Barrier Additives for Polymer Materials

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Theoretically the permeability ratio of composites to polymer matrices is a function of the aspect ratio ($L/t$) of the 2D nano-platelet and its volume fraction ($\phi$) in the composites. The improved barrier properties of nanocomposites are mainly due to a tortuous path around these nanosheets, forcing the gas permeant to travel a longer path to diffuse through the film.

Current Barrier Additives for Plastic Packaging

Usually high volume fraction needed due to its low aspect ratio in plastics.

A promising alternative due to its impermeable to most gases, but it absorb light. This limits its application in plastic packaging where transparency required.

Material and Process

Polyethylene Terephthalate (PET) resin was used as polymer matrix.

An internal mixer and a platen press were used to mix BN with polymer and make thin films for oxygen permeation analyses.

Conclusions

Boron Nitride nanosheets with a mean aspect ratio around 1300 were produced by liquid-exfoliation.

Melt processing involving dispersing BN nanosheets directly within the polymer melt was carried out in an internal mixer. This method is most applicable for industrial applications. The resultant PET-BN films have outstanding gas barrier while keeping good processability, flexibility and transparency.

We have demonstrated that the layered hexagonal boron nitride (h-BN), an analogue of graphene, can be used as a new barrier additive for plastic packaging.

References: