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## Method of Producing Cubic Boron Nitride Films


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Reference: Cubic Boron Nitride


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## Overview

Cubic boron nitride (cBN) is widely used as an abrasive for industrial tools as well as for other applications such as coatings and insulation. In addition to possessing the desirable properties of diamond, it also overcomes some of diamond's drawbacks by exhibiting high thermal stability in the presence of oxygen and chemical inertness with iron, nickel and related alloys. Most current methods of cBN synthesis produce films with a cubic-phase content of well less than 100 percent, even going under 50 percent. Other methods with higher yields exhibit other difficulties, such as limits to the grain size and, therefore, to the ultimate thickness of films that can be obtained. This method for synthesis of cBN films can produce films with near 100 percent cubic-phase content and a larger grain size.

## Advantages

- Produces a higher quality, near 100% cubic phase film
- Produces larger grain size, allowing for larger films
- Rapid and economic process

## Description

With most cBN synthesis techniques it has been difficult to obtain pure or near 100% cubic phase boron nitride films, while those methods that have produced high purity cBN have generally required the use of energetic ion bombardment of the substrate. Such bombardments form nanocrystalline films which have a limited grain size. In addition, using ion bombardment creates a problem of resputtering of the boron and nitrogen atoms away from the substrate after a certain size film has been formed, further limiting the size and purity of the films.

As a result, large crystalline structure growth of cBN films is inhibited and at some point stopped. Thus, conventional synthesis techniques for forming cBN films that utilize ion bombardment generally provide only a limited window of growth for the crystalline films and typically are unable to provide cBN films of the high purity and sufficiently large grain sizes desired for many applications.

For this invention, a hexagonal boron nitride film target is positioned in front of an RF magnetron sputtering gun and is impacted with ions to cause atoms of boron and nitrogen to be sputtered away from the target and toward a substrate. At the same time, electrons are emitted into the system which are attracted to the substrate as the boron and nitrogen atoms are being deposited. The electrons cause the boron and nitrogen atoms to be reformed on the substrate as cubic phase BN while suppressing the formation of other, less desirable forms of BN.

## Status

- United States Patent Number 6,153,061
- This invention has been successfully verified by laboratory experiment

## Licensing Opportunities

- This technology is available for exclusive or non-exclusive licensing