

Supplementary Information

Vertically Self-Ordered Orientation of Nanocrystalline Hexagonal Boron Nitride thin films for enhanced thermal characteristics

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Additional TEM to confirm the presence of c-BN in the film

Some more TEM pictures taken from the same sample have been analysed and shown below in fig. III and fig. IV. FFT images were computed for several zones in the film where c-BN nanocrystals are thought to be and the diffraction pattern shows cycle distances of 0.21 nm and 0.18 nm, which correspond to the (111) and (200) orientation of c-BN respectively. The presence of c-BN nanocrystals can be seen in the glancing angle XRD scan of the film in fig. V. The peak is contributed by both (111) of c-BN and (101) of h-BN, with reference to JCPDS file no. 25-1033 and JCPDS file no. 34-0421 respectively. This agree well with the FFT of TEM image in Fig. 5 in the manuscript.

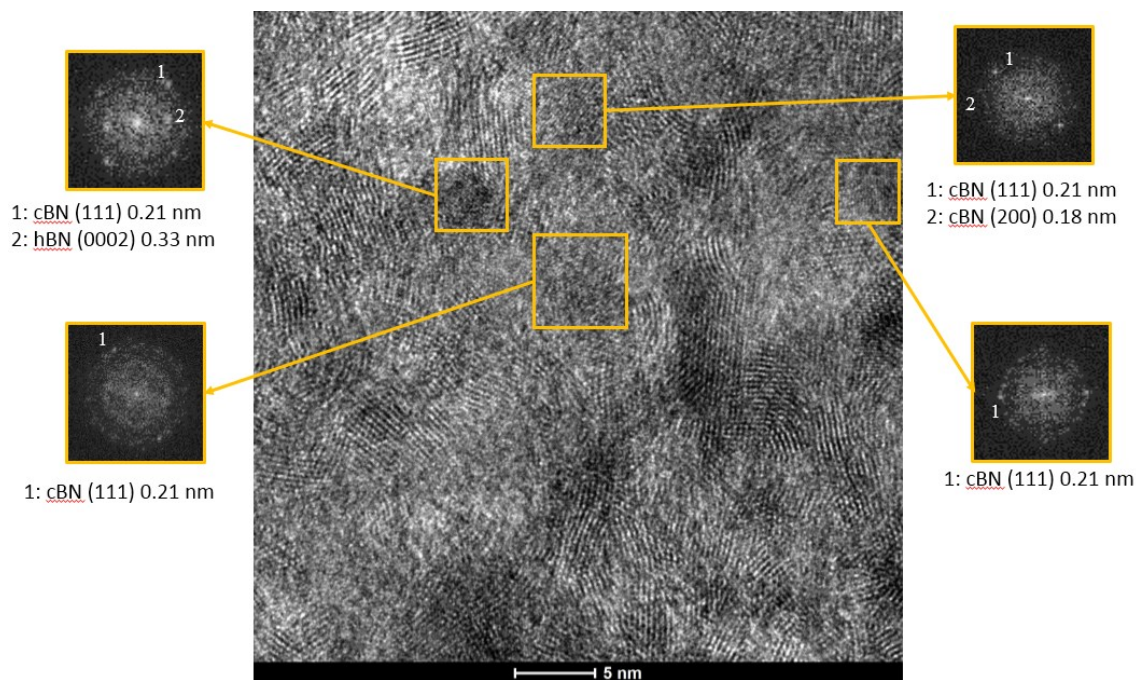


Fig. III HRTEM of the c-BN/t-BN sample. The insets at both sides of the image display FFT computation of possible c-BN nanocrystals located in the yellow boxes. The diffraction lines show cycles matching the c-BN values.

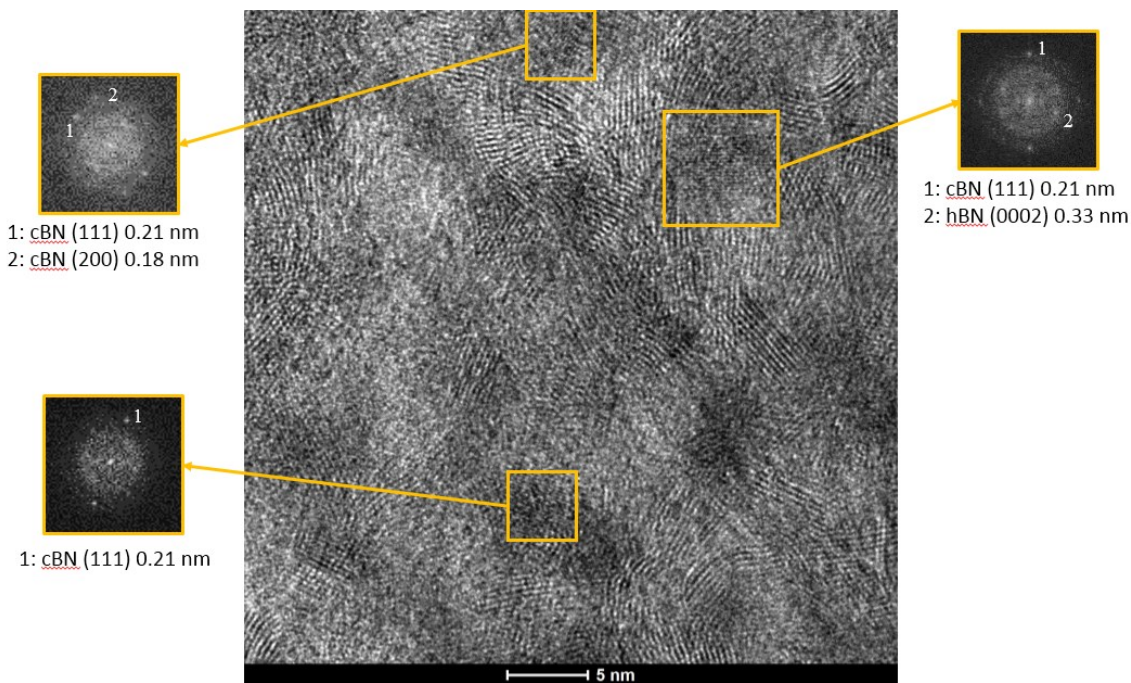


Fig. IV HRTEM of the c-BN/t-BN sample. The insets at both sides of the image display FFT computation of possible c-BN nanocrystals located in the yellow boxes. The diffraction lines show cycles matching the c-BN values.

Additional XRD Scans of Our Samples

XRD was done with Shimadzu XRD 6000, using Bragg Brentano Geometry. The divergence slit and scatter slit is at 1 degree. The receiving slit is 0.3mm.

The rocking curve scan at 2θ of 26.764° is done on the oriented BN film to detect the orientation of the (002) plane of h-BN¹, as shown in Fig. V(a). There is a sharp peak which is centered at ω of 13.35° . This indicates that the (002) h-BN plane has a strong preferred orientation normal to the film.

A 2θ scan is performed from 25° to 28° with ω fixed at 13.35° , using a step size of 0.01° , with a scan speed of 3 seconds per step. The phi angle is optimized by performing a phi angle scan with ω fixed at 13.35° and 2θ fixed at 26.764° , the phi angle which the maximum intensity is obtained is used for the measurement. The (002) h-BN plane is detected as a broad peak at around 2θ of 26.6° , as shown in Fig. V(b). This is inconsistent with the FFT of the TEM images in Fig. 1 (a) in the manuscript, as the FFT shows that the (002) plane is located in the in-plane direction of the film. This broad peak may be contributed by the transition layer in the film.

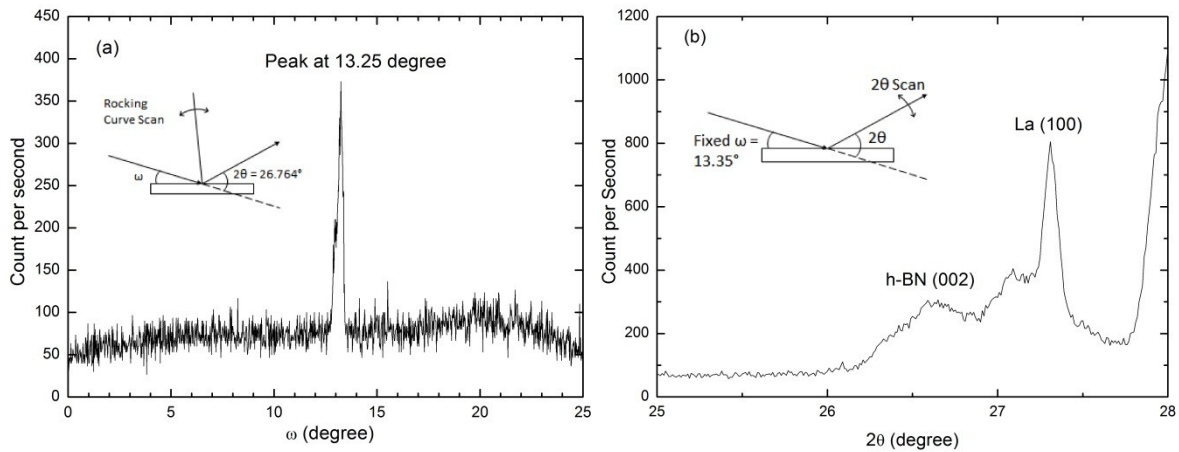


Fig. V (a): Rocking Curve Scan of ordered h-BN film, with 2θ fixed at 26.764° . (b): 2θ scan of the ordered h-BN film, with ω fixed at 13.25° .

1. N. B. S. (U.S.), in *Monogr.* 25, 20, 22, 1984, vol. Card No, 34-0421.