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Photoemission and x-ray absorption of hexagonal Boron Nitride prepared by interaction of Boron vapor with Nitrogen ions

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We present a study of the texture and crystalline perfection of hexagonal boron nitride (h-BN) films based on x-ray absorption near edge structure (XANES) and x-ray photoemission (XPS) spectroscopies. The measurements were conducted at BESSY synchrotron facility using beamline PM4. The synchrotron results are also compared with the more conventional infrared and Raman spectroscopies.

Hexagonal BN films were grown by ion-beam-assisted deposition (IBAD) through B evaporation and concurrent N₂⁺ ion bombardment. XANES and XPS reveal that the quality of h-BN layers can be controlled through ion bombardment and heat treatments, and provide unique information to optimize the growth conditions. Furthermore, the nitrogen ions contribution leads to a compressive stress in the films that tends to orient the basal planes perpendicular to the substrate. The texture of h-BN films is studied by XANES at different angles of incidence, a technique very well suited to study the orientation of π bonded systems. In this way, we have obtained a map of basal plane orientation as a function of growth conditions.

The quality of the h-BN films is discussed in terms of the XANES and XPS data, by comparing the amount of vacancy defects and the width of the spectral features.

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