This ESI version replaces the version published on 30 Jan 2026, which did not include Fig. S8

Effect of ammonia borane thermal decomposition under different Ar fluxes on large-area boron nitride films for quantum photonic applications

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Supporting Information

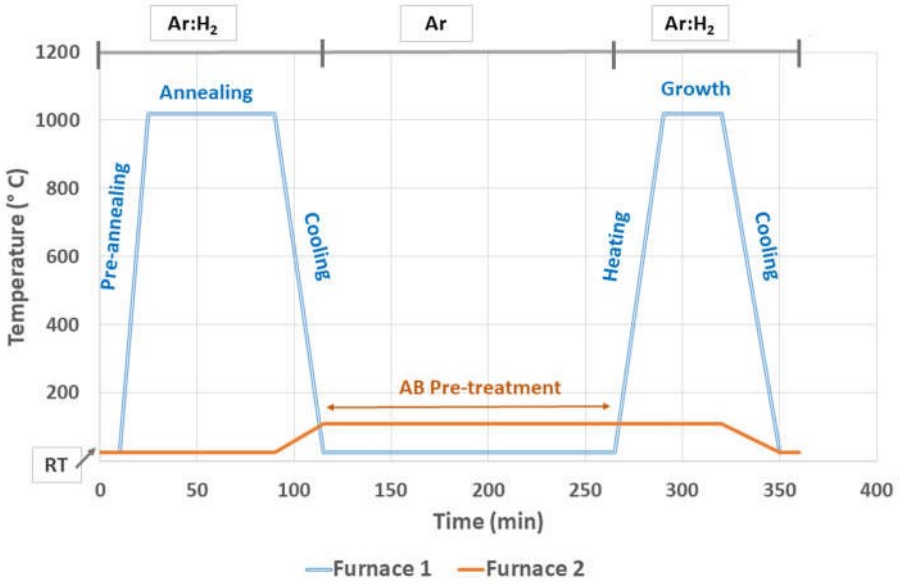

Fig. S1: *Temperature profile of the BN film growth process, including the precursor pre-treatment where AB is preheated at 110 °C for 150 min. Further information on the AP-CVD growth process can be found in the Materials and Methods section.*

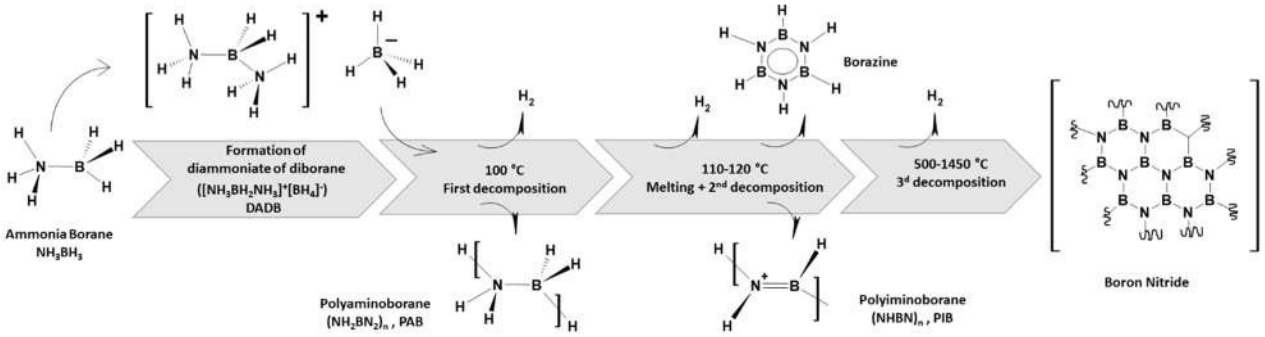

Fig. S2: *Schematic diagram of the thermal decomposition of AB powder from its pure state into boron nitride (the commonly accepted decomposition route of ammonia borane* [1,2]*.*

Figure S3a shows an optical micrograph of the as-grown BN-LF thin film on Cu foil. The BN films deposited on Cu are hard to locate in either optical images or SEM images (Fig. S3a,c) as the rolling lines (black dashed lines) dominate the Cu surface. Figures S3b,c show the SEM micrographs of as-grown BN-LF thin films on 25 µm Cu foil at different growth times of 10 min and 20 min, respectively; the rough surface of the Cu substrate provides a great number of preferential nucleation sites for grain growth [3]. The BN grains notably increase in size as the growth time increases from 10 to 20 min. Moreover, the grains indicated with white arrows in Figure S3c are not uniform in size and shape compared to those illustrated in Figure S3b".

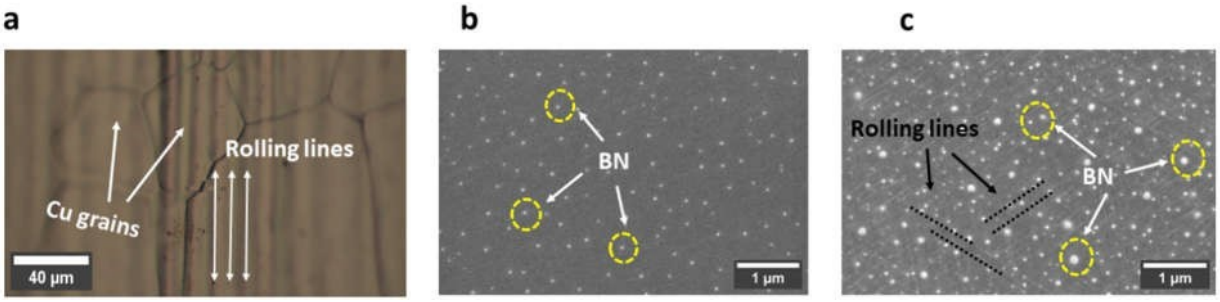

***Fig. S3**: (a) Optical micrograph of as-grown BN-LF thin films after 20 min of deposition on a Cu foil substrate, showing visible rolling lines. SEM image of as-grown BN-LF for (b) 10 min and (c) for 20 min. The dashed yellow circles in (b) and (c) indicate BN nucleation sites. The dashed black lines in (c) represents prominently observed rolling lines.*

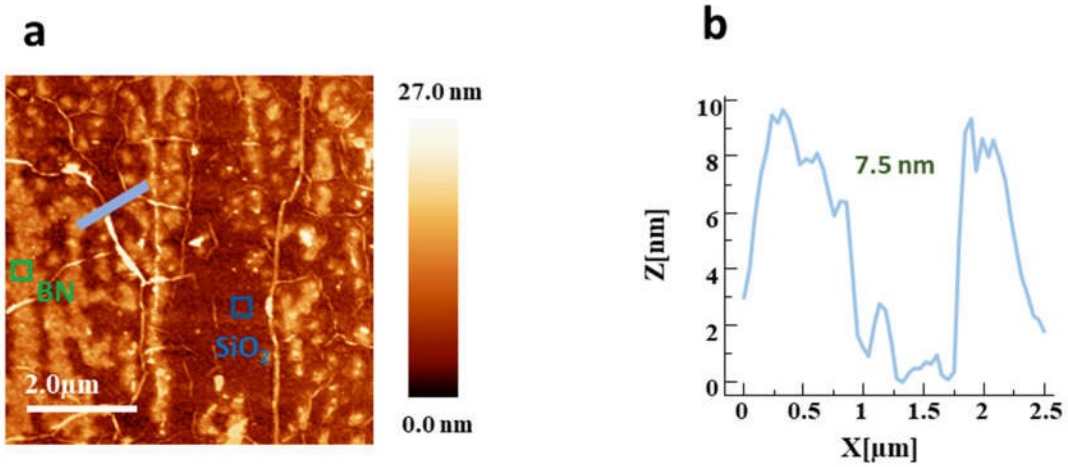

***Fig. S4:** (a) AFM topography of the transferred BN-HF films on SiO_2/Si for 30 min deposition. Other AP-CVD parameters are as reported in section 2.1. (b) Line profile along the cyan solid line in the AFM image (a).*

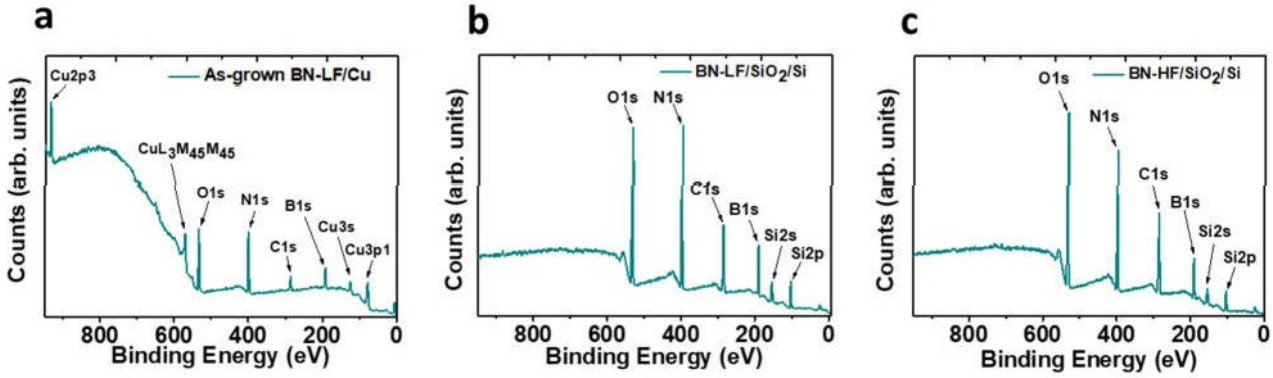

***Fig. S5** XPS survey spectra of (a) as-grown BN-LF on Cu foil and transferred films onto SiO_2/Si substrates (b) for BN-LF and (c) for BN-HF.*

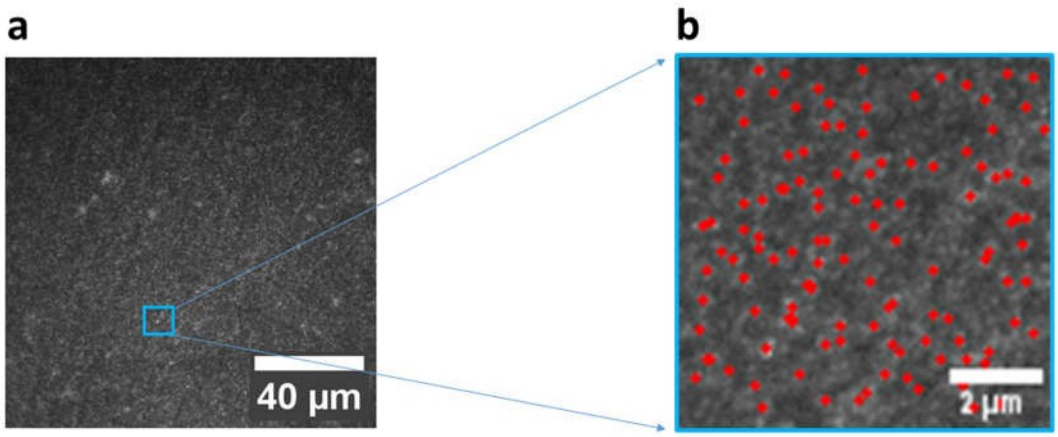

Fig. S6 *(a) High-resolution TIRF microscopy image of a few multilayers of BN-LF on a glass coverslip (0.13-0.16 mm thick). (b) ThunderSTORM imaging of optically active photon emitters in the BN-LF films reconstructed from a selected area of 8 µm².*

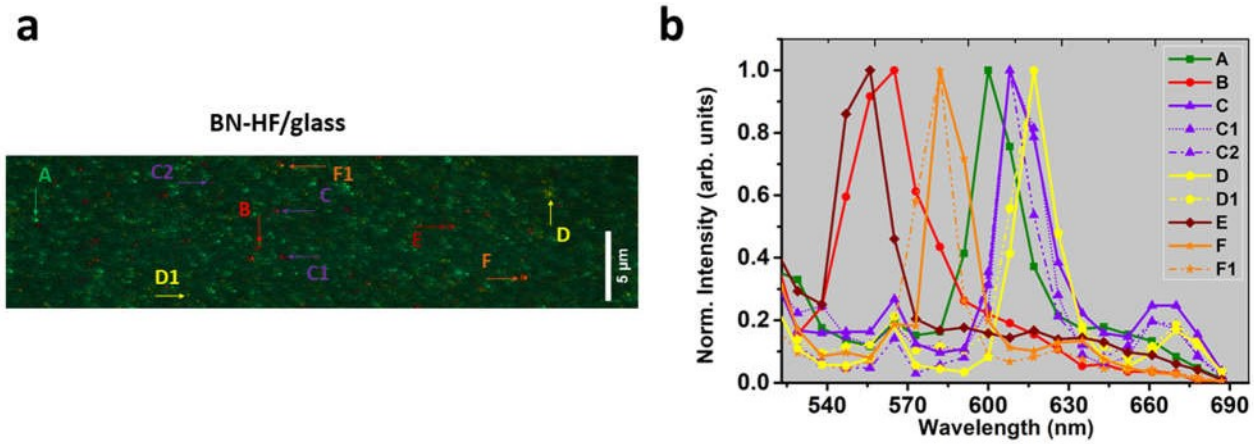

Fig. S7 *(a) Hyperspectral confocal fluorescent image for BN-HF film, with a selected 10 bright spots (color centers) labelled as A, B, C, C1, C2, D, D1, E, F, and F1. (b) HCFM image exhibits small ensembles of quite similar emission wavelengths with ZPL at 582 nm (orange), 608 nm (violet), and 617 nm (yellow).*

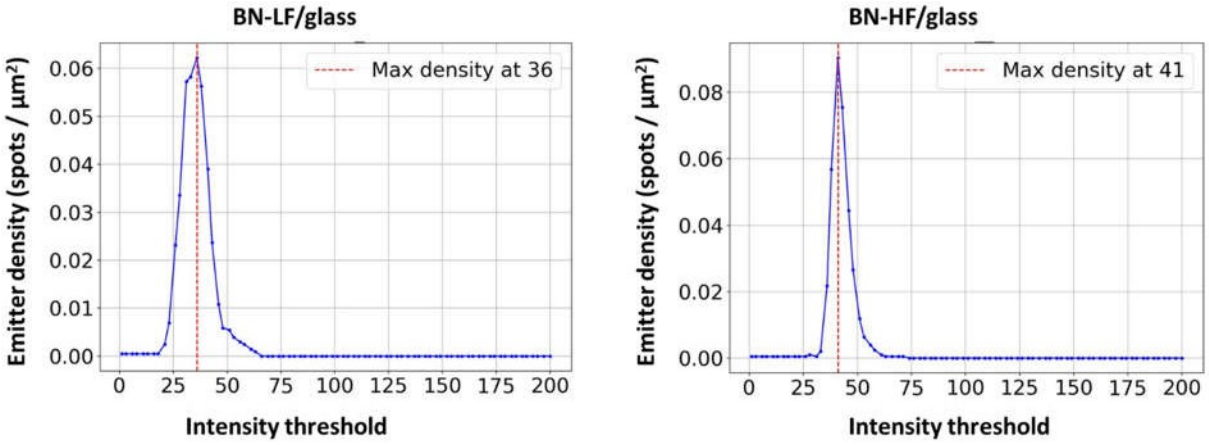

Fig. S8*: Emitter density as a function of intensity threshold for BN-LF (left) and BN-HF (right) thin films.*

References:

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