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MICRO HOLLOW CATHODE DISCHARGES IN ARGON/NITROGEN USED FOR BORON NITRIDE PECVD

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Abstract. A Plasma Enhanced Chemical Vapor Deposition (PECVD) process based on Micro Hollow Cathode Discharges (MHCDs) (Schoenbach K. H. et al., 1996) in Ar/N_2 mixture has been developed to deposit hexagonal boron nitride (h-BN), a material of choice for electronic and optoelectronic applications. We have shown the feasibility of h-BN deposition on large area substrates (2 inches) at relatively low temperature (800°C) compared to conventional processes (Kabbara H. et al., 2020). To optimize and better understand the deposition process, the discharge is characterized experimentally and through modelisations. In particular, we use Two-photon Absorption Laser Induced Fluorescence (TALIF) to measure the nitrogen atom density, a key parameter in the process. TALIF measurements show that the atomic nitrogen is produced inside the MHCD hole and can be transported over long distances using a pressure differential between the two sides of the MHCD. To achieve the h-BN deposition, the substrate holder must be polarized which involves a homogenization of the density profile along the substrate's surface (Remigy A. et al., 2024). The introduction of an electric field and the secondary discharge is the trigger for nitride deposition and not, as would be expected, the N atoms density in the vicinity of the substrate.

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