

Supporting Information

***In-situ* Si doping of heteroepitaxially grown c-BN thin films at different temperatures**

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In order to obtain silicon concentration at 420, 600 and 900 °C, a tri-layered silicon doped c-BN film was prepared and investigated by ToF-SIMS. Fig. 1 presents a ToF-SIMS depth profile for this tri-layer film. In this film, the first layer as grown at 420 °C directly on the silicon substrate, followed by a c-BN layer grown at 900 °C, and the top layer is grown at 600 °C. Each of these regions is distinguished by vertical solid line in Fig.1, while the BN signal shows very homogenous profile through all three temperature regions, the Si dopant exhibits three particularly different concentrations depending on the temperature. Due to the missing exact calibration, we could not extract the exact value for the exact concentration. However, the different count ratios related to each temperature step still could deliver useful information. If we take the impurity counts within the 420 °C region as 1, the impurity counts in the other temperature regions can be easily calculated. For example, silicon in 600 °C region has a count ratio $\text{Si}(600^\circ\text{C})/\text{Si}(420^\circ\text{C})=0.65$, and silicon in 900 °C region has a count ratio $\text{Si}(900^\circ\text{C})/\text{Si}(420^\circ\text{C})=0.43$. Considering the Si concentration estimated for silicon doped c-BN films grown at 900 °C in our previous publication¹, those concentrations can be extracted for silicon doped films grown at 420 °C and 600 °C, respectively.

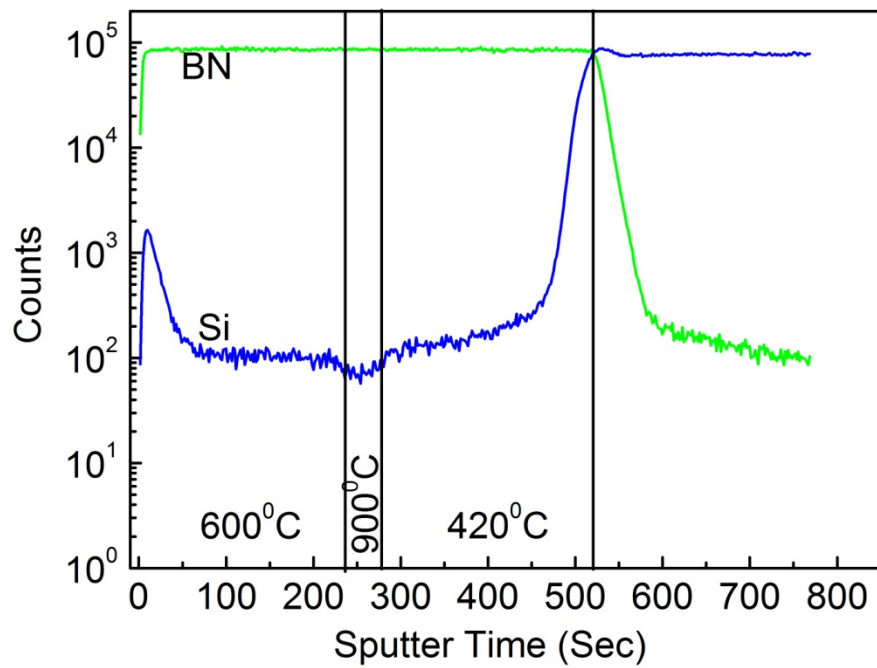


Fig. 1 Depth profile of ToF-SIMS for the negative ions in tri-layer silicon doped c-BN film on silicon substrate

Reference:

1. H. Yin, H.-G. Boyen, P. Ziemann, B. Dohuard, L. Houssiau, F. Renaux, M. Hecq and C. Bittencourt, *Diamond Relat. Mater.*, 2008, **17**, 276.