Synthesis of uniform hexagonal boron nitride films on metallic glass by annealing

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Abstract

Hexagonal boron nitride (h-BN) has been demonstrated as an ideal insulating layer for various two-dimensional materials, such as graphene and transition metal dichalogenides (TMDs), which helps to boost their intrinsic physical and electrical properties [1]. Such an insulator also shows outstanding resistive switching effect under different voltage [2]. h-BN films on large scale with homogeneous thickness and low roughness are usually desired, however, it is still very challenging to realize such goals by common chemical vapor deposition (CVD) method due to the poor control to the thickness or the high cost of substrate fabrication [3]. Here we show that by simply annealing in ammonia [4], h-BN films as thick as 12 nanometers can be easily synthesized by using commercial boron-containing metallic glass as the substrate with low cost. Moreover, due to the specific "self-limited" growth, the as–synthesized films show very high homogeneity. Raman spectra of the films implies that the quality of such films can be further improved by long time annealing. X-ray Photoelectron Spectroscopy (XPS) was used to explore the composition evolution of the films during annealing process. The synthesized film showed promising applications in memory devices. Such scalable synthesis method with low cost has the potential to be developed for industrial production for applications in modern electronics.

References

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Figures

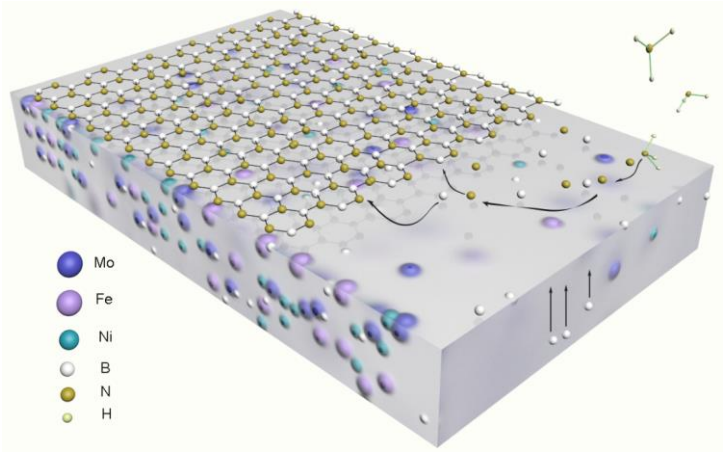

Figure 1: Schematic show of the growth process. Metallic glass has an amorphous structure, during annealing boron atoms diffuse from the bulk and react with nitrogen atoms on the metal surface forming hexagonal boron nitride.