

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

Xin Chen¹, Abhay Shivayogimath¹, Anton Bay Andersen¹, Cunzhi Sun¹, Vitaly Babenko², Stephan Hofmann², Tim Booth¹ and Peter Bøggild¹

¹ Department of Physics, Technical University of Denmark, Fysikvej, 2800 Kgs. Lyngby, Denmark

² Department of Engineering, University of Cambridge, 9 JJ Thomson Avenue, Cambridge, CB3 0FA, United Kingdom

Background: What is metallic glass?

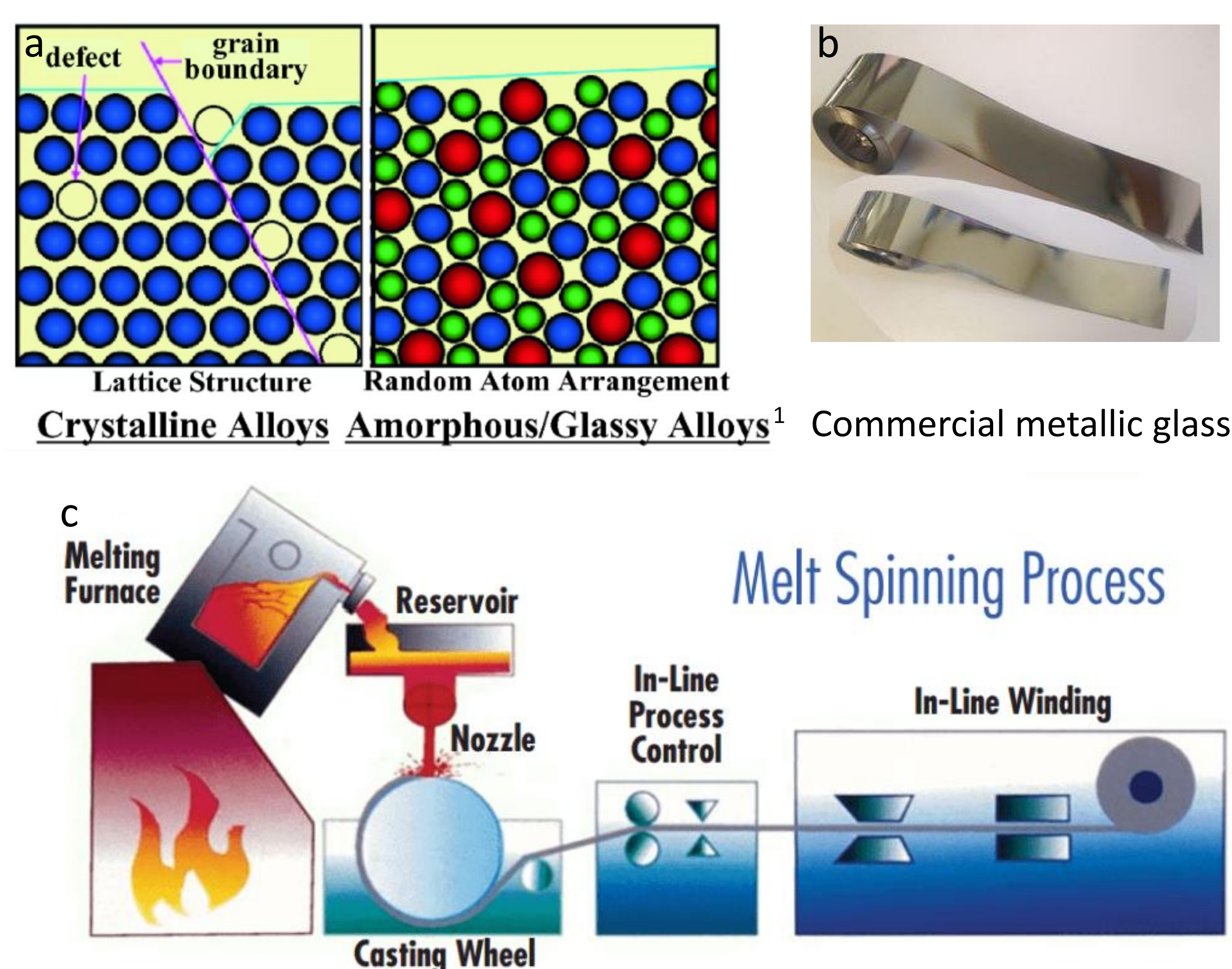


Fig. 1. (a) Difference between crystalline alloy and glassy alloy on the atomic scale. (b) Image of commercial metallic glass. (c) A processing schematic for metallic glass production. (Image from Metglas Inc.)

Methods

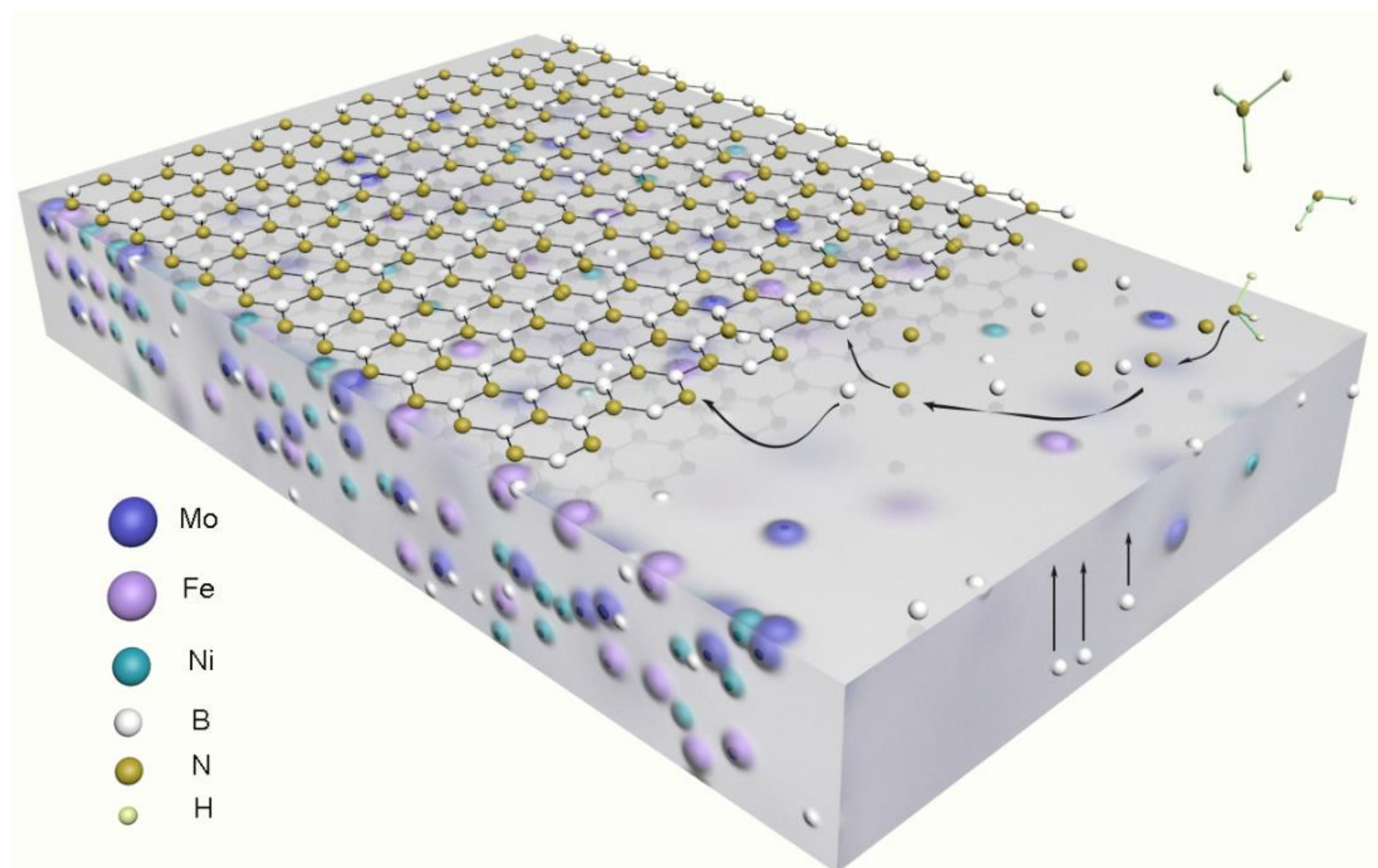


Fig. 2. Metallic glass $\text{Fe}_{40}\text{Ni}_{38}\text{Mo}_4\text{B}_{18}$ is used for the synthesis. During annealing in NH_3 atmosphere, boron atoms will diffuse to the surface and react with nitrogen atoms forming h-BN films.²

Results

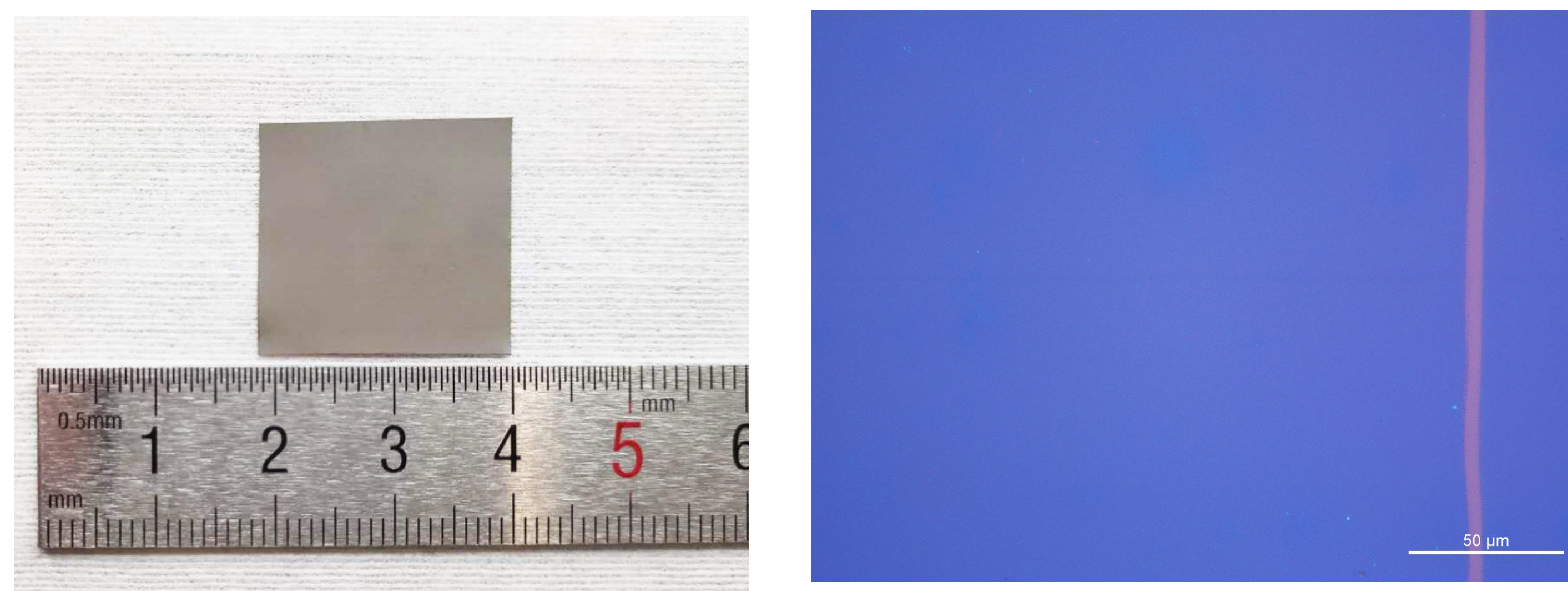


Fig. 3. Optical images of h-BN on metallic glass before (Left) and after (Right) transfer.

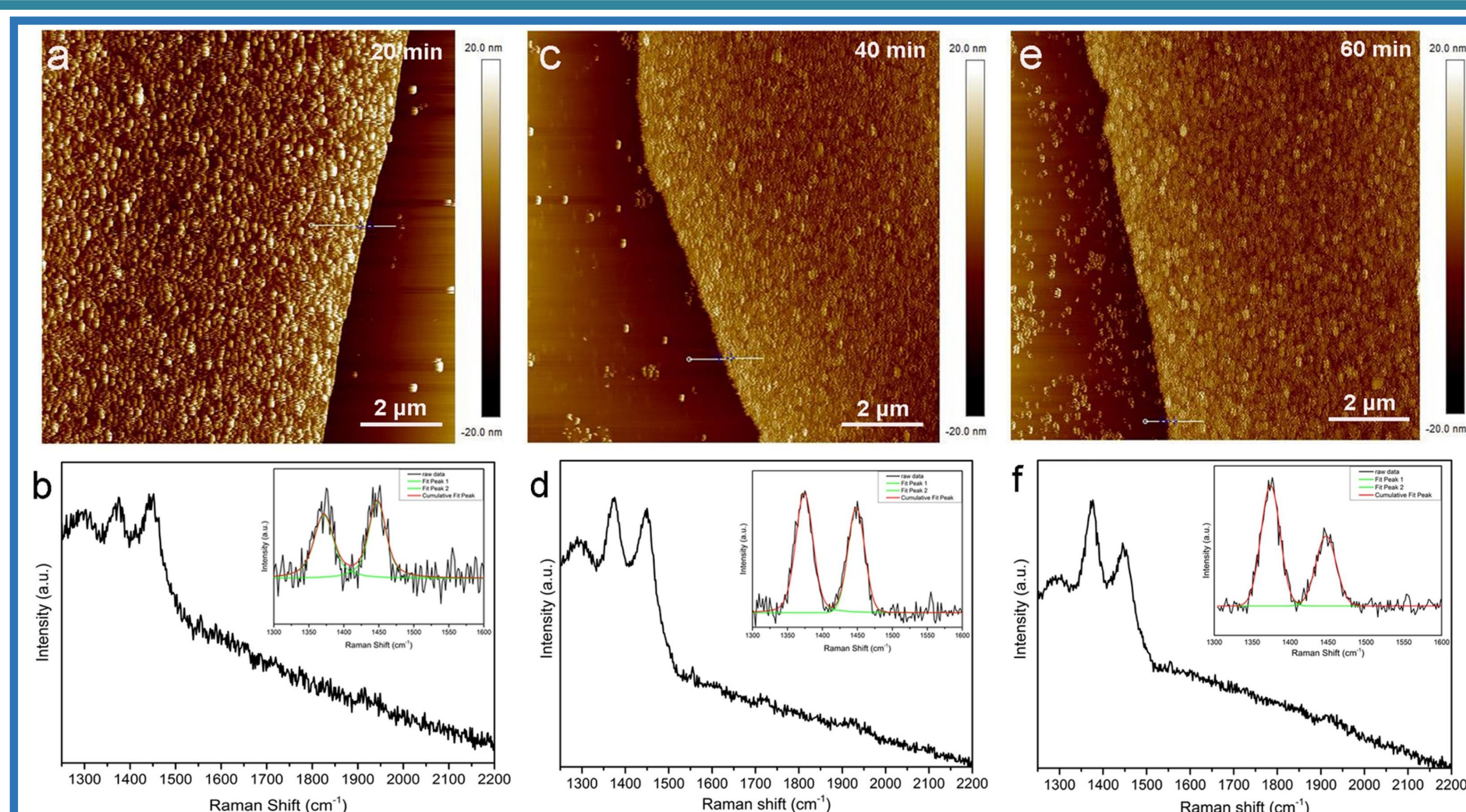


Fig. 4. AFM images of h-BN films synthesized by different annealing time after transfer. Increased ratio of E_{2g} to Si peak indicates enhanced crystallinity.

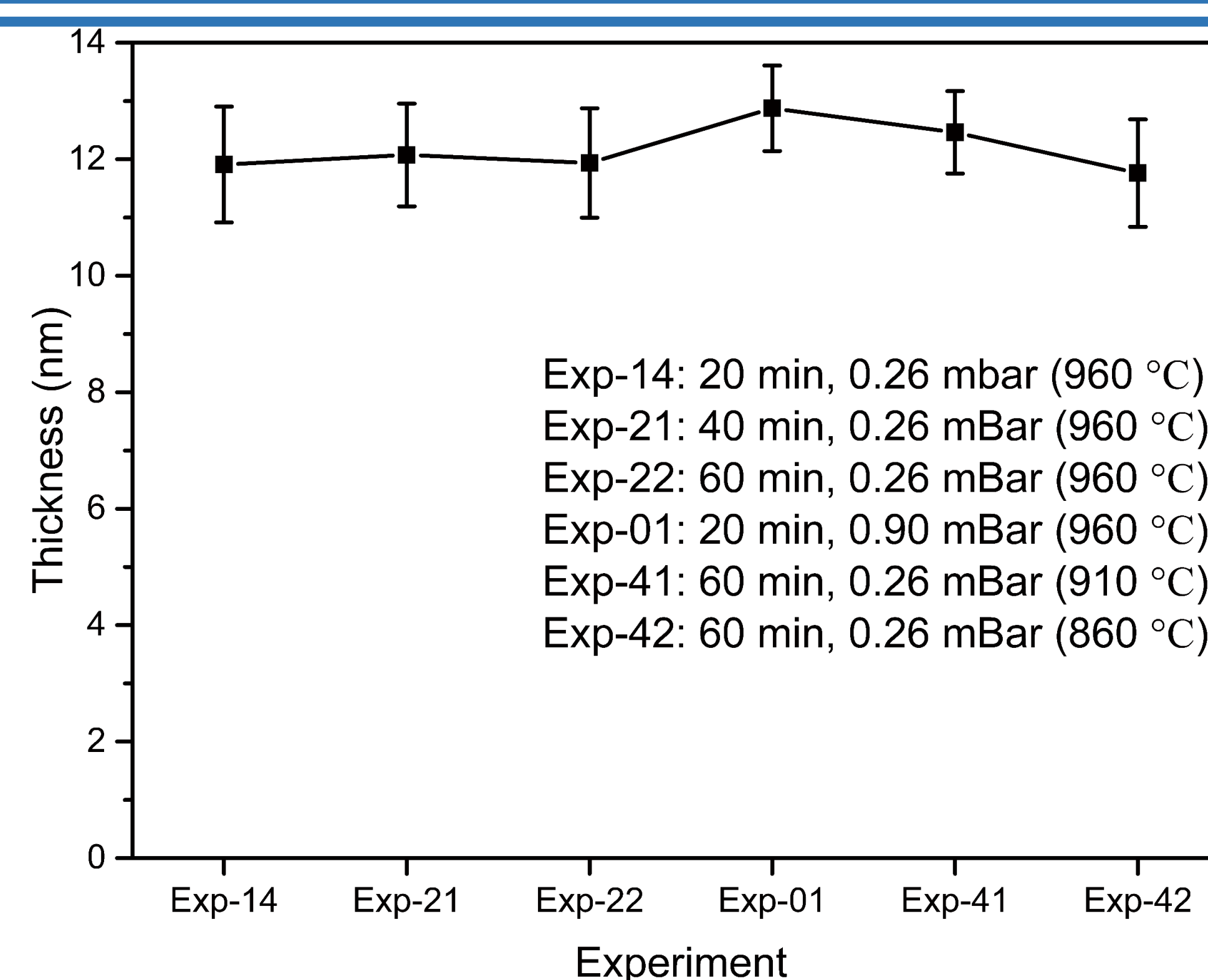


Fig. 5. Self-limited growth of h-BN films. Under different annealing conditions, h-BN films show quite similar thickness of ca. 12 nm.

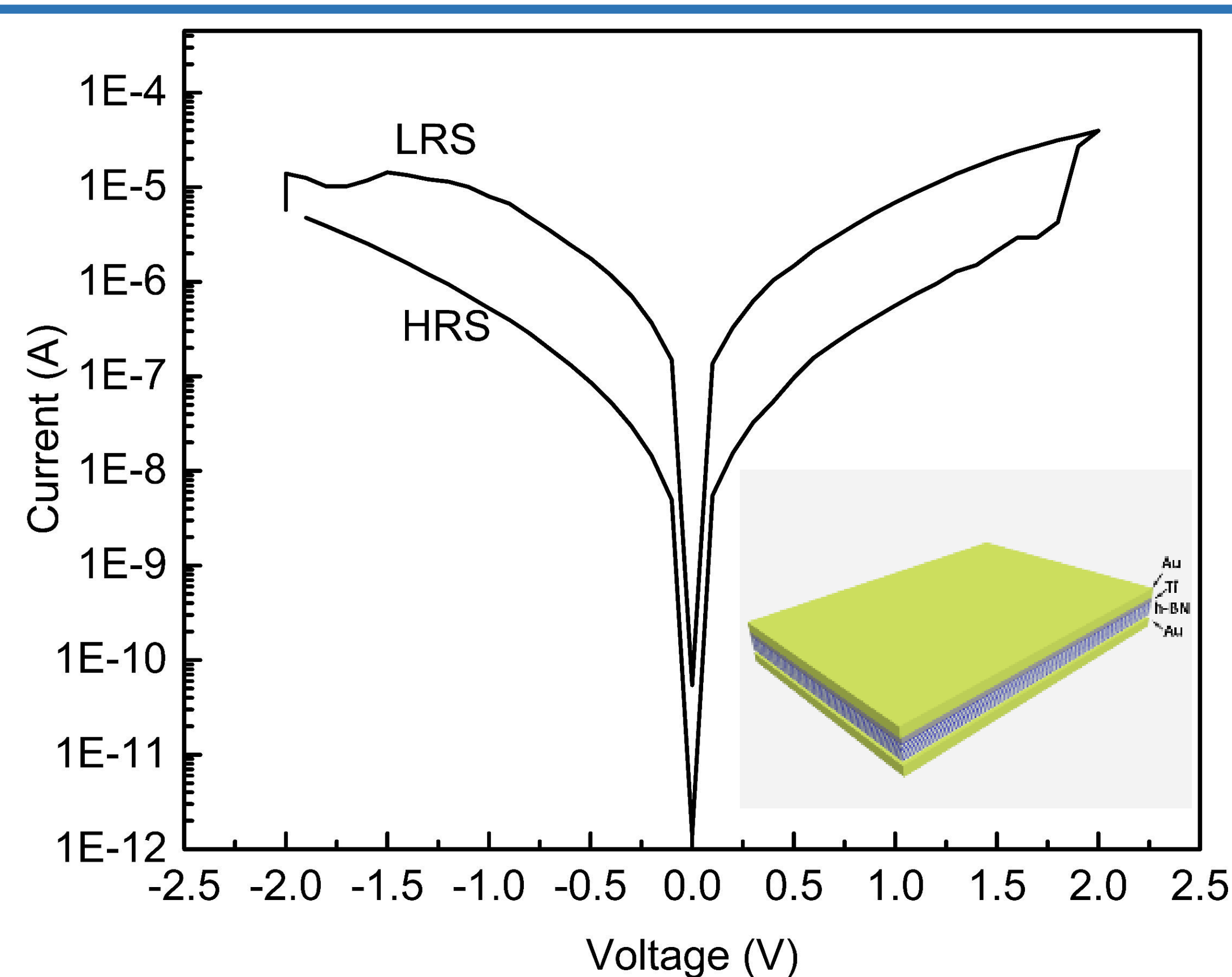


Fig. 6. Transition between low-resistance state (LRS) and high-resistance state (HRS) under different voltage of h-BN films.³ Inset shows the structure of the device. (Ongoing)

CONCLUSION

- 1 A low-cost method for h-BN synthesis on large scale is developed.
- 2 Films show high homogeneity in thickness due to self-limited growth.
- 3 Potential application in electronics is demonstrated.

REFERENCES

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- 3 C. Pan, et al., Adv. Funct. Mater. 27 (2017) 1604811.