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# Effect of growth temperature on composition control for YBCO precursor films fabricated by vapor codeposition

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The promising physical properties of multi-element functional nanofilms are essentially dependent on each particular nanostructure, which could be greatly altered by the change of stoichiometry [1]. The vapor deposition techniques are good at controlling the composition of deposited atoms, and therefore it has become one of the most versatile approaches to synthesize functional nanofilms [1–4]. During some synthesis processes, the deposited atoms need to undergo a reconstruction to build the desired nanostructure through sufficient atomic diffusion, which requires that the substrate should be heated and kept at certain temperature [5]. However, high temperate could affect the adsorption (desorption) behavior of the deposited atoms and then makes the composition control much more complicated. Based on this consideration, the objective of this work is to understand the role of growth temperature on the composition control during coevaporation. Specifically, the composition control for the YBCO precursor films under various growth temperatures is explored in this study. $Y_t$, $BaF_2$, and Cu are deposited simultaneously on $LaAlO_3$ single crystal substrates and the composition is determined by the inductively coupled plasma atomic emission spectroscopy (ICP-AES). The experimental results indicate that the sticking probability of the Cu atoms is sensitive to the growth temperature, as growth temperature increases the sticking probability decreases. However, it also shows that the sticking probability for both $Y_t$ atoms and $BaF_2$ molecules can be not affected by changing growth temperature within the range from room temperature to 600°C. Moreover, when the growth temperature is high, as the composition of $BaF_2$ in the precursor films increases the sticking probability of Cu atoms decreases obviously, while at room temperature the influence of the composition of $BaF_2$ on the sticking probability of Cu vanishes. The mechanisms associated with above phenomena are discussed, and the information and insights provided by this work is valuable for handling the composition control of the co-deposited precursor films at high growth temperature.

## References

1. Zhang S. *Nanostructured Thin Films and Coatings: Functional Properties*. CRC Press, New York (2010)
2. Fan J, Boyd I D, Shelton C. *Journal of Vacuum Science & Technology A*, **18**: 2937–2945 (2000)
3. Zhang J, Liu C, Shu Y, Fan J. *Applied Surface Science*, **261**: 690–696 (2012)
4. Wang L, Shu Y, Fan J. *Science China-Technological Sciences*, **55**: 2291–2294 (2012)
5. Liu C, Zhang J, Wang L, Shu Y, Fan J. *Solid State Ionics*, **232**: 123–128 (2013)