Effect of substrate bias on properties and microstructure of nano-twinned Copper thin films deposited by magnetron sputtering systems

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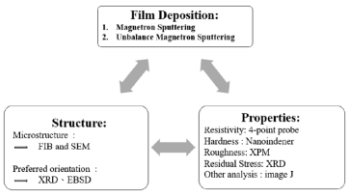
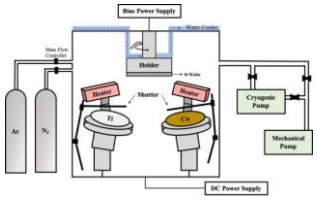
Experimental procedure





Microstructure and preferred orientation of nanotwinned Cu films

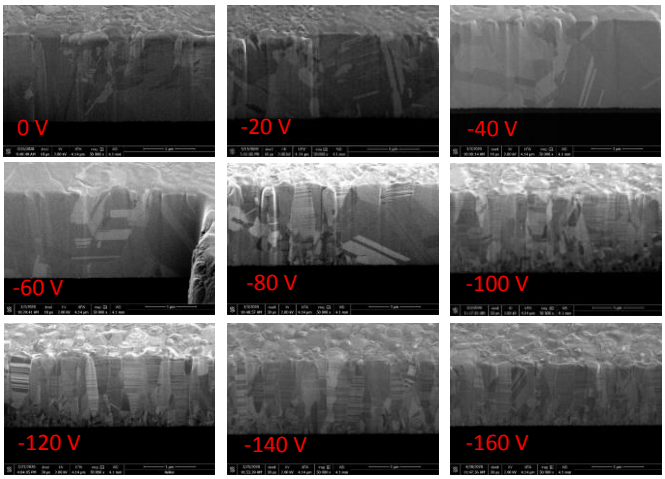


Figure 1. Cross-sectional microstructure images of as-deposited Cu films with different substrate biases.

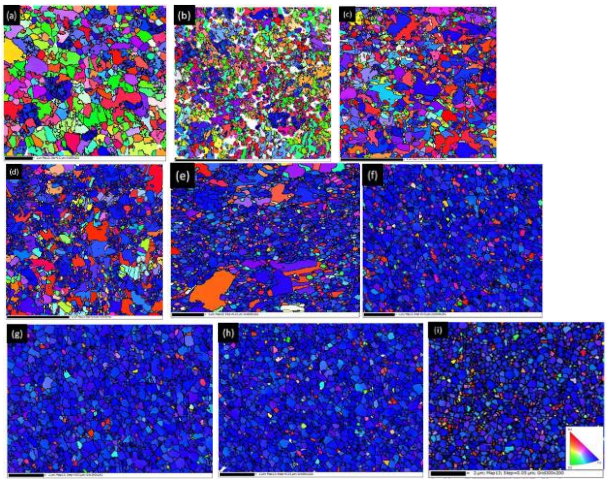


Figure 2. Plan-view EBSD images of as-deposited Cu films, (a) 0V (b) -20V (c) -40V (d) -60V (e) -80V (f) -100V (g) -120V (h) -140V (i) -160V.

XRD results of nanotwinned copper films

(a) (b)

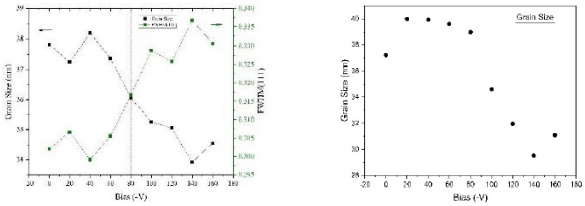


Figure 3. Grain sizes calculated by Scherrer equation, (a) calculated from (111) peak, (b) calculated from (200) peak.

(a) (b)

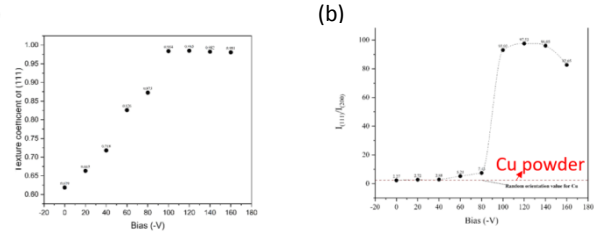


Figure 4. Orientation of Cu films as a function of substrate bias (a) Texture coefficient of (111) (b) Ratio of relative diffracted intensities $I_{(111)}/I_{(200)}$.

Properties of nanotwinned copper films

(a) (b)

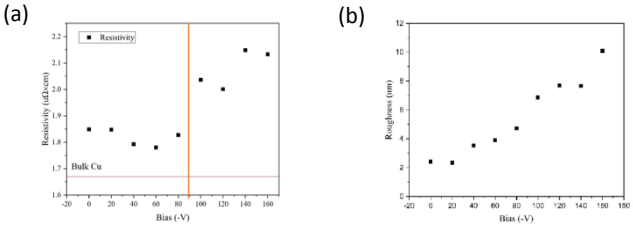


Figure 5. Measured properties versus different substrate biases. (a) resistivity (b) roughness

(a) (b)

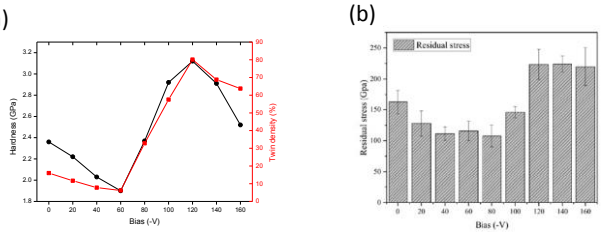


Figure 6. Measured properties versus different substrate biases. (a) hardness and twin density (b) residual stress.