Status of laser annealing of Nb coated samples

Arturs Medvids

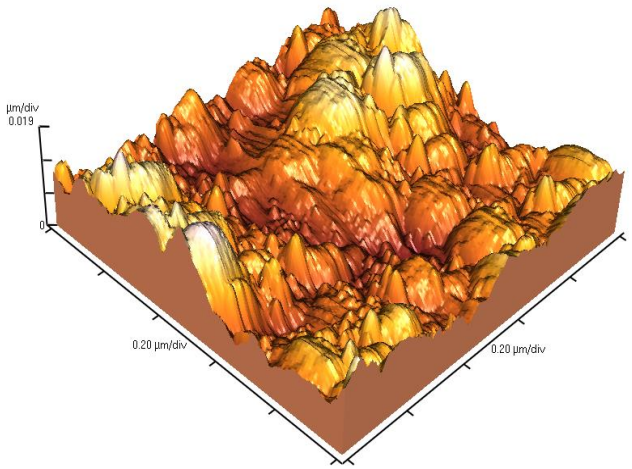
Influence of Laser Radiation on Surface Roughness of Nb/Cu Structure

Experimental

Nb films were deposited by HiPIMS (magnetron sputtering) with pulse width of 100 µs, repetition rate of 200 Hz, average plasma current of 600 mA, peak current of 40 A and a krypton pressure of 500 mTorr. Sample Nr. 1/7/16 – 500 ˚C deposition temperature with 0V DC substrate bias (grounded) for 240 mins onto copper substrate which was pre-annealed to 700˚C for 12 hours prior to deposition.

The sample was irradiated by Nd:YAG laser (λ= 1.064 µm, τ =6 ns and intensity I=193.7 MW/cm^2) in scanning mode with step 5µm in Ar atmosphere.

a)



b)

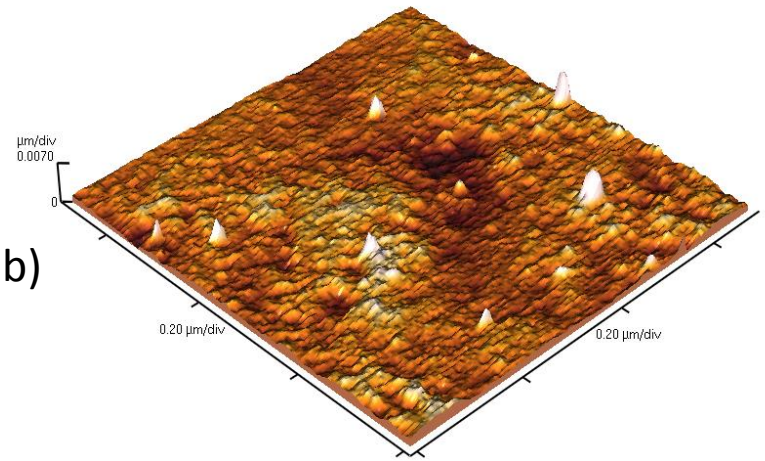
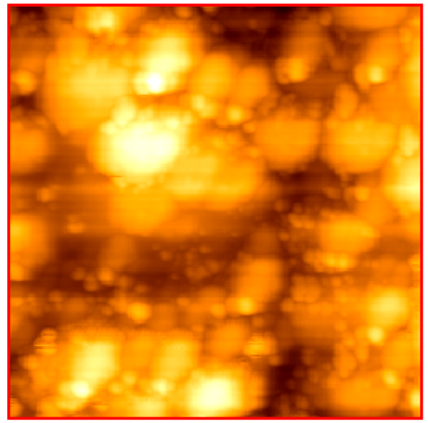
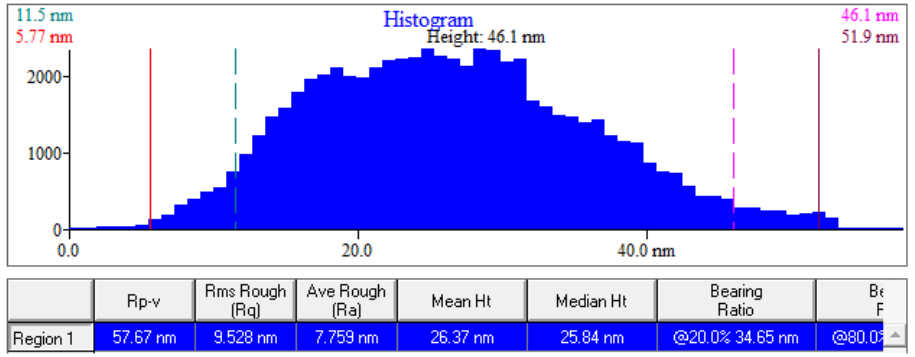


Fig.1. 3D AFM images of Nb/Cu sample (1/7/16) : non-irradiated (a) and irradiated by Nd:YAG at intensity I=200.0 MW/cm^2 (b).

a) non-irradiated

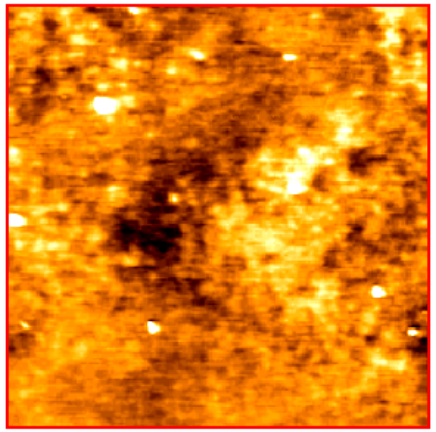


(254,256) x: 0.992 µm y: 1.000 µm z: 0.09502 µm

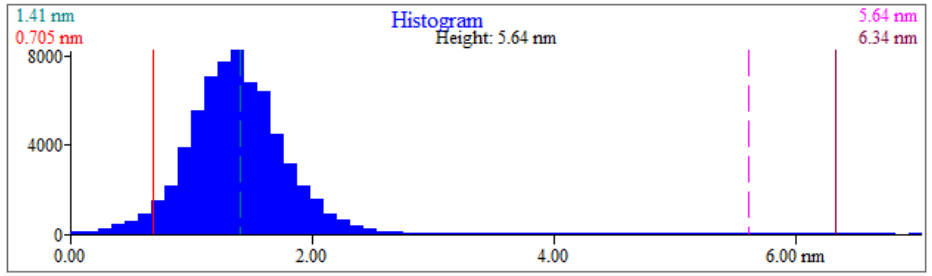


	Rp-v	Rms Rough (Rq)	Ave Rough (Ra)	Mean Ht	Median Ht	Bearing Ratio	Be F
Region 1	57.67 nm	9.528 nm	7.759 nm	26.37 nm	25.84 nm	@20.0% 34.65 nm	@80.0%

b) irradiated



(253,136) x: 0.683 µm y: 0.3673 µm z: 0.001156 µm



	Rp-v	Rms Rough (Rq)	Ave Rough (Ra)	Mean Ht	Median Ht	Bearing Ratio	Be F
Region 1	7.047 nm	0.4379 nm	0.3129 nm	1.377 nm	1.363 nm	@20.0% 1.67 nm	@80.0%

Fig.2. 2D AFM images of the non-irradiated (a) and the irradiated (b) Nb/Cu sample (1/7/16) and region analyses. The Nb surface roughness RMS (Root Mean Square Roughness) of the **non-irradiated is 9.528nm** and for laser **irradiated it is 1.233 nm**.

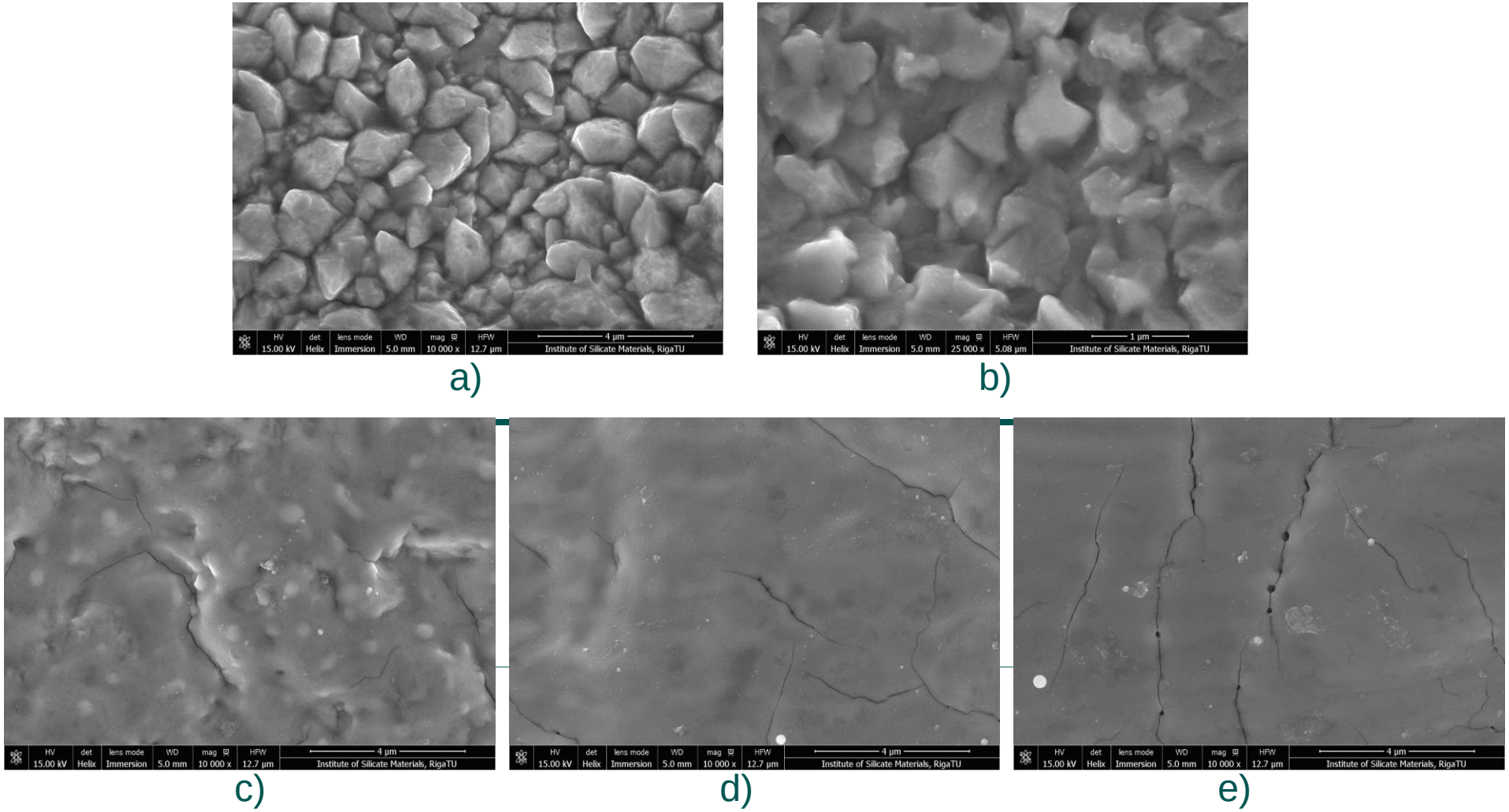


Fig.3. SEM images of Nb/Cu sample Nr.22/3/16 before irradiation (a) and after irradiation by Nd:YAG laser with Intensities: I_1 = 140 MW/cm^2 (b); I_2 = 170 MW/cm^2 (c); I_3 = 253 MW/cm^2 (d); I_4 = 320 MW/cm^2 (e).