Structure and optical properties of a-C coatings doped with nitrogen and silicon

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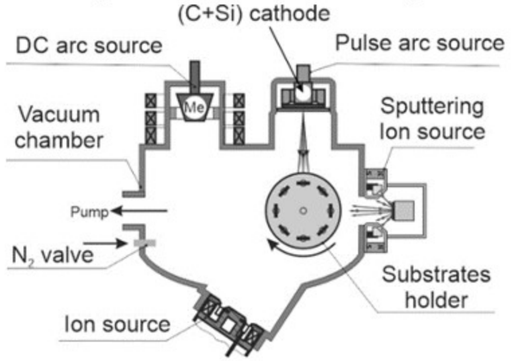
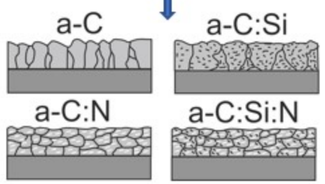
The aim of this work is to establish the effect of alloying of carbon coatings with nitrogen and silicon on their optical properties

Deposition technique



Schematic diagram of the deposition process



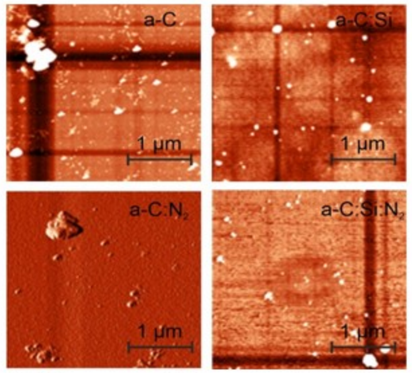
Schematic diagram of structure design of a-C based coatings

Experimental technique

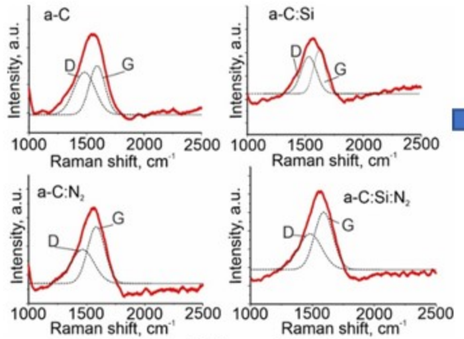
Solver P47 PRO (NT-MDT, Russia)

Raman (Senterra, Bruker)

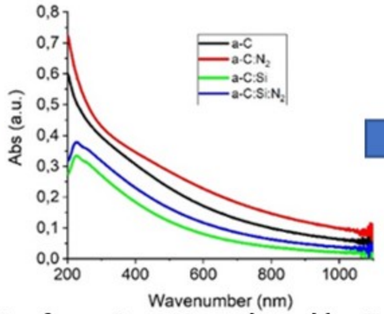
Cary-50 (Varian) spectrophotometer



AFM images of doped a-C coatings



Raman spectra of doped carbon coatings

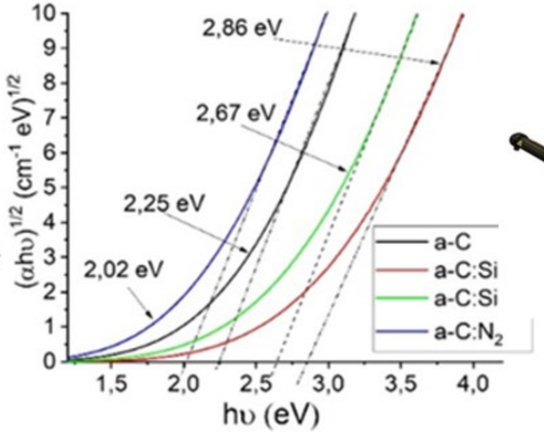


Uv-Vis spectra for α-C coatings doped by Si and N

Results

Coating	Roughness Ra, nm	Average radius of grain, nm
α-C	18.7	7.1
α-C:Si	11.3	6.3
α-C:N_2	31.8	8.2
α-C:Si:N_2	21.8	8.6

Coating	Csp^2/Csp^3 ratio	ID/IG ratio	d, nm	n	k
α-C	0.38	1.17	101.2	2.71	0.019
α-C:Si	0.26	1.66	88.9	2.72	0.015
α-C:N_2	0.72	1.78	85.4	2.62	0.021
α-C:Si:N_2	0.36	0.79	79.4	2.65	0.023



Tauc plot of (αhν) versus photon energy hν for α-C

LEF-757 (IFS SB RAS, Russia)

Conclusions

The regularities of the influence of alloying carbon coatings with nitrogen and silicon on their optical properties have been determined. A change in Eg and n is a sign of a change in their optical properties due to the formation of a cluster structure with different cluster sizes and sp2 / sp3 bond ratios, as well as chemical compounds between azo, silicon and carbon. The ability to control the semiconductor properties of coatings makes them promising for use in various microelectronic devices.