Characteristics of nanocomposite sol-gel films on black silicon surface

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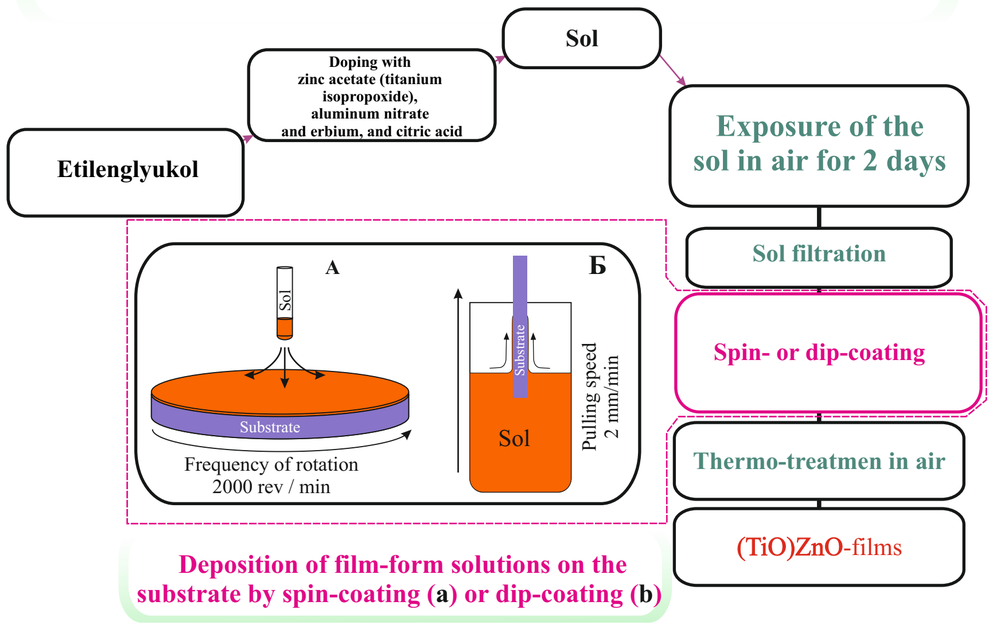
The main stages of sol-gel process



Deposition of film-form solutions on the substrate by spin-coating (a) or dip-coating (b)

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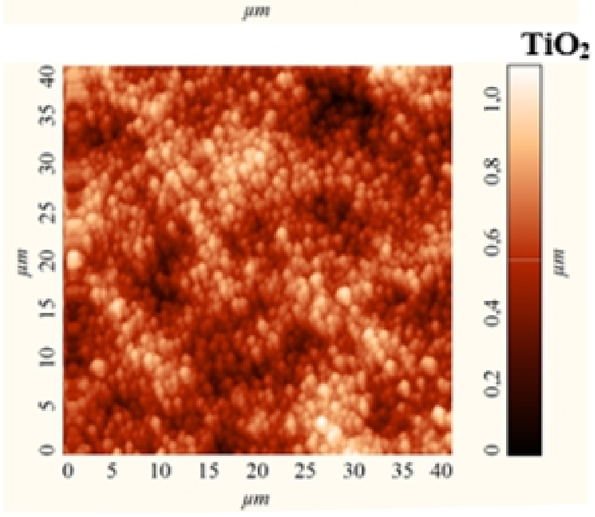
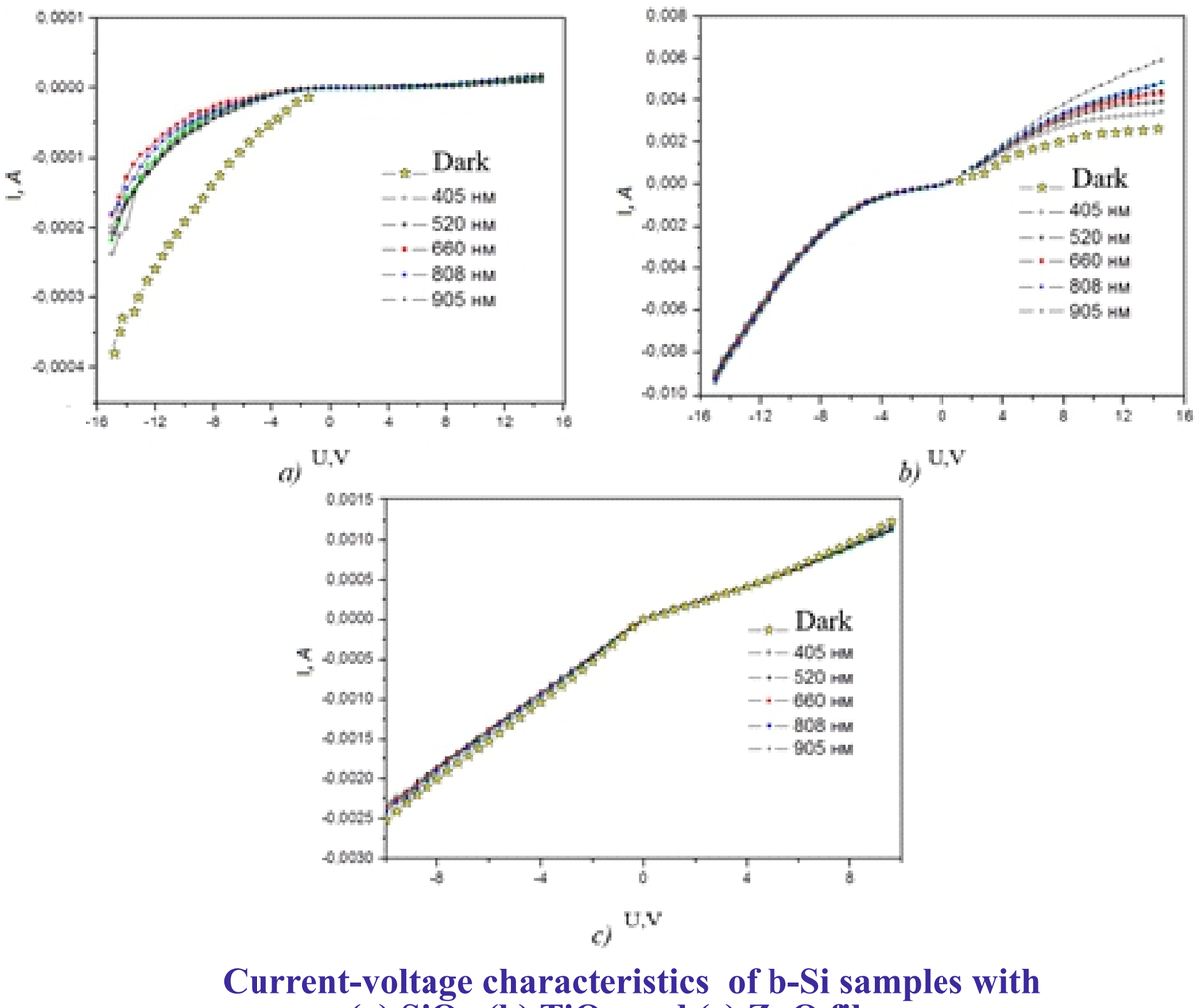
Grain statistics on the surface of functional coatings obtained by the sol-gel method on the surface of black silicon: SiO_2 - based on Si $(C_2H_5O)_4$ / $SiC_8H_{20}O_4$, ZnO - based on zinc acetate, TiO_2 - based on titanium ethoxide

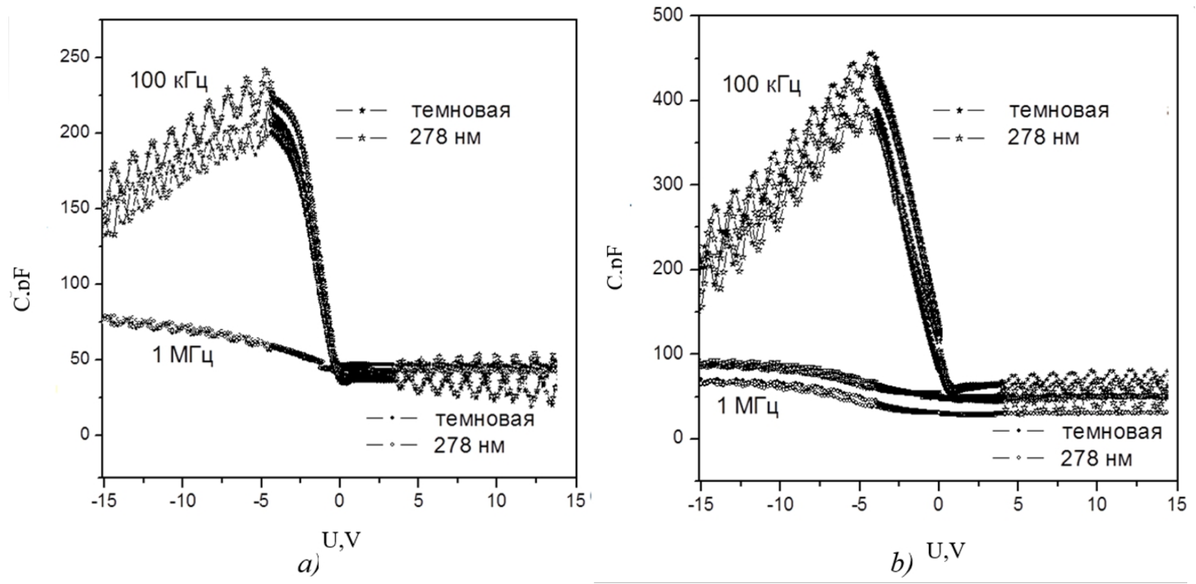
Characteristic	Substrate type		
	SiO_2	ZnO	TiO_2
Number of grains	266	1150	1202
Roughness, Ra, мм	0,225	0,155	0,118
Average grain size, мм	1,5	0,7	0,75



AFM images of the surface topography of (a) SiO_2, (b) ZnO, and (c) TiO_2 films on b-Si



Current-voltage characteristics of b-Si samples with (a) SiO_2, (b) TiO_2, and (c) ZnO films.



CV-characteristics of b-Si samples with (a) ZnO and (b) TiO_2 films.

From the analysis of AFM images, it can be seen that when using SiO_2 sols based on Si $(C_2H_5O)_4$ / $SiC_8H_{20}O_4$. The average particle size on the surface of functional coatings is about 1.5 μm, the roughness is 0.225 μm, and when using ZnO sols, it is based on zinc acetate and TiO_2 - based on titanium ethoxide, the particle size is reduced by 2 times, the roughness is reduced by 1.5 - 2 times.

The structural and photoelectric characteristics (CVC and CVC) of thin sol-gel ZnO, TiO_2, and SiO_2 films on the b-Si surface are studied. It has been shown that it is preferable to use ZnO and TiO_2 films as passivating and protective films of solar cells based on b-Si, which have stable structural and optical properties and, at least, do not worsen the reflection of b-Si in the near infrared and visible regions. solar radiation. In addition, the multifunctional nature of these films on the b-Si surface makes it possible in principle to use them as an active layer in devices for various purposes (in tandem solar cells, photodetectors, physical and chemical sensors, information visualization devices) temperatures.

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