Resistive Switching Effect in the Composite Films of Fluorinated Graphene with Organic Additives.

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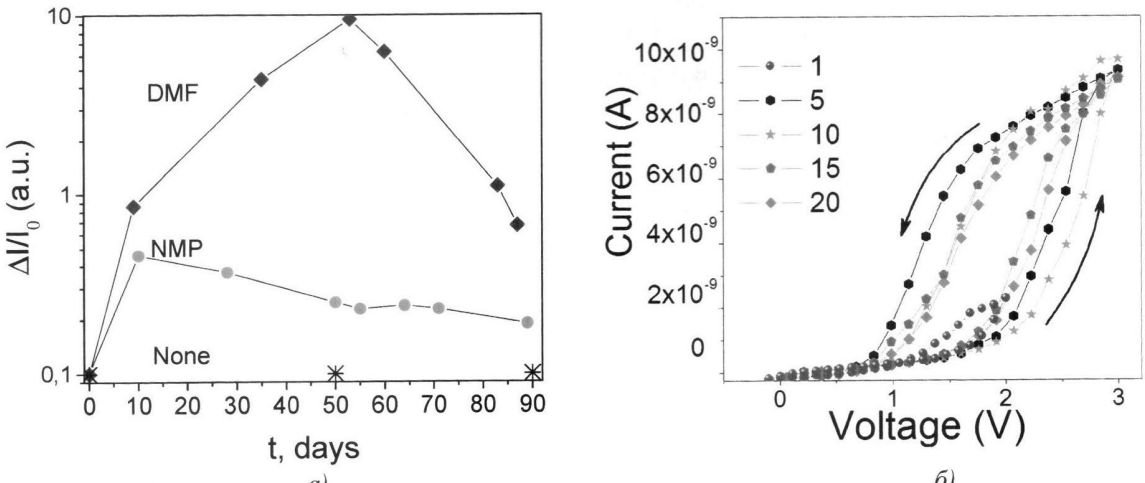
Today a wide range of materials are used for the fabricating of memristors. In recent years structures based on graphene oxide (GO) showing resistive switching represent the great interest, but these memristors were found to exhibit unstable resistive effect. It is fluorographen (FG) that being more stable derivative of graphene, and partially fluorinated graphene with variable properties is considered as a promising material for fabricating of memristors [1].Original procedure for preparing fluorinated graphene in aqueous hydrofluoric acid solution has been developed by researchers of our laboratory [2].

In the present report we have investigated the resistive switching effect in the composite films of fluorographen with different organic additives. We have used such components as polivinil-alcohol, with it employing for creating of additional layer on the surface of silicon wafer when fluorographene film printing, dimethylformamide (DMF) and N-methylpyrrolidone (NMP) as additives to creation of suspension, because these substance leads to effective exfoliation of graphene from graphite. Unexpectedly, resistive switching effect was found to strongly dependent on these additives. It was found, that if suspension of fluorographene not contained any traces of organic additives, (see Fig.1.*a)*, the resistive switching is not observed in fabricated films. Structures based on suspension with NMP exhibit resistive relatively weak switching effect (less than 0,4 a.u.), while adding DMF in suspension leads to change in resistance of films in 10 tames. Thus, the most strong resistive effect is observed for fluorographene films with traces of dimethylformamide (Fig.1*a*). For the structures fluorographene film on polivinil alcohol layer and silicon substrate created with use of 2D printed technologies the resistive effect was found to be also strong. Investigating the last structures, we have observed the most stable resistive switching with change in resistance on one order of magnitude (Fig.1*b*). Repeated measurements more than 20 times demonstrates practically the same current – voltage characteristics.



a) *б)*

Fig.1: a) Dependences of the relative change in current as a function of fluorination time for suspension with different organic additives (NMP and DMF) and without one. b) Current - voltage characteristics for vertical FG-PVA printing structure. A number of measurement cycles is given as a parameter.

The influence of different organic additives on the resistive switching effect in films of fluorinated graphene and origin of this effect are discussed in this report. The presence of substance traces affects on the formation of conductive paths in partially fluorinated graphene films. Generally, the most promising structures with resistive effect are the films based on suspensions containing traces of DMF or layered structures with polivinil-alcohol.

This study was partially financed by the Russian Science Foundation (grant No. 15-12-00008).

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