Photothermally reduced graphene oxide as a platform for a sensing application

Nikolay S. Struchkov[1]
A.V. Romashkin[1], I.A. Komarov[2], O.M. Antipova[3], V.A. Kondrashov[4], D.S. Kopylova[4], A.G. Nasibulin[4]

[1]*National Research University of Electronic Technology, Shokin Square, 1, Zelenograd, Moscow, Russia*
[2]*Bauman Moscow State Technical University, ul. Baumanskaya 2-ya, 5, Moscow, Russia*
[3]*Lomonosov Moscow State University, Leninskie Gory, 1, Moscow, Russia*
[4]*Skolkovo Institute of Science and Technology, Nobel str. 3, Moscow, Russia*

struchkov.nikolaj@gmail.com)

Reduced graphene oxide is a novel promising material for energy storage, optoelectronic and sensory application. Development of high sensitive photo-, bio-, gas sensors with reduced graphene oxide functional layers requires fabrication of thin uniform graphene oxide films on various substrates, including flexible, hydrophobic materials and ones with developed surface. Spray deposition was chosen as a universal technique fulfilling all specified requirements and the most promising one for industrial application. An optimum spray process parameters and suspension composition were determined, for successful deposition of uniform graphene oxide films with thickness above 15 nm, see Figure. 1.
To investigate sensing properties of reduced graphene oxide, thick (>100 μm) films were patterned by local photothermal laser assisted reduction. Average power of solid-state laser (wavelength 445 nm) was varied in range 20-400 mW by pulse-width modulation with frequency 30 MHz. An effect of oxygen content in atmosphere on reduction process was studied. Process parameters were optimised for partial and highly reduced graphene oxide fabrication.
Patterned high conductive films possessed bolometric properties and demonstrated high photothermal voltage response (up to 69 $V \cdot W^{-1}$) and operation rate (~0.14 ms) [1].
Reduced graphene oxide considered as the perspective transducer material for biosensing application. Dependence of efficiency of aptamer covalent coupling to the surface of partial reduced graphene oxide on reduction rate was studied [2].

References

[1] V.A. Kondrashov, N.S. Struchkov, , R.Y. Rozanov, V.K. Nevolin, D.S. Kopylova, , A.G.Nasibulin, Nanotechnology, 29(3) (2017) 035301
[2] I.A. Komarov, S.N. Scherbin, A.N. Kalinnikov, M.A. Orlov, V.A. Seleznev, N.S. Struchkov, O.M. Antipova, S.A. Smagulova, International Journal of Mechanical Engineering and Technology, 9 (13) (2018) 1420–1430

Figures

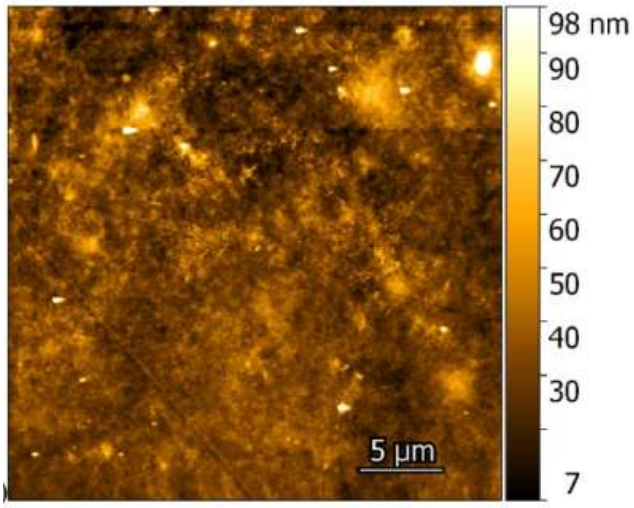

Figure 1: Spray deposited graphene oxide thin films on PET substrate