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ABSTRACTS BOOK

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30 keV. GLFs were grown from ethanol-water vapour at 950°C. The pressure in a reactor was about 10^3 Pa. For grown films, sheet resistance, magnetoresistance, carrier mobility and concentration depending on the temperature were measured. It was shown that our results correspond to the values obtained by other authors for direct grown films. This work was supported by the Russian Foundation for Basic Research (project no. 18-32-00047).

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NANO-28

Nickel polyphthalocyanine – 2D conductive polymer

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Polyphthalocyanines (PPCs) are a unique class of two-dimensional polymers [1]. Like graphene, they possess a 2D-conjugated electronic system, but in contrast to graphene, PPCs have finite band gap, pronounced magnetic properties and high catalytic activity. The main problem that hinders the applications of PPCs is the lack of processability: they are practically insoluble in any solvents and cannot be melted or evaporated. Because of this, PPCs cannot be treated by the conventional processing methods like spin-coating, sputtering or thermal evaporation. Yet, for practical applications it is desirable to obtain the polymer in a form of thin films on any arbitrary wafer, in particular on dielectrics.

Earlier we reported a new route to the synthesis of CuPPC thin films by reaction of pyromellitic tetranitrile (PMTN) with copper [2]. This approach is suitable for NiPPC. Reactions in a CVD (chemical vapor deposition) set-up were performed in a vertical quartz tube, placed in a two-zone oven. The first zone (170°C) was used for PMTN evaporation, while the second one (400°C) was used for the synthesis. The process was carried out at a reduced pressure (~10^3 Pa) in flow of hydrogen (1 l/h).

The results of FTIR and Raman spectroscopy, as well as TEM shown that in this way NiPPC films of high uniformity and polymerization degree can be obtained. Electrophysical measurements confirmed that NiPPC is highly promising material for semiconductor technology.

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NANO-33

The effect of titanium incorporation on the properties of W-Ti-B superhard films deposited by PLD and MS methods.

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Metal borides indicate outstanding physical properties such as electric and thermal conductivity comparable with metals, high incompressibility and shear strength and exceptionally high hardness. Due to all these desirable attributes, these materials are very attractive for materials researchers, who investigate their properties depending on different deposition parameters or with addition of some chemical elements [1,2]. The aim of this study are tungsten borides coatings such as WB, WB2 and WB3 doped by Ti. These ternary borides indicate a significant increase of hardness in comparison to WBx. According to Akopov et al [2], hardness of W0.92Ti0.08B4 is 50.9 ± 2.2 GPa while pure WB4 is 43.3 GPa. What is more, aforementioned WB4 doped by Ti showed substantial growth of oxidation resistance up to ~460°C, compared to ~400°C for WB4.

In this paper coatings have been deposited by Pulsed Laser Deposition (PLD) or Magnetron Sputtering (MS) methods from the W0.92Ti0.08B4 target made by Spark Plasma Sintering (SPS) method. The effect of different titanium addition on the microstructure, mechanical properties and corrosion resistance have been studied. This differences derived from conscious changes of laser power during deposition. The deposited films were characterized by X-ray diffraction and surface area was observed with the use of scanning electron microscope + EDS. Besides that, microhardness by Vickers method and optical profile have been done. Corrosion resistance investigations, involved electrochemical impedance spectroscopy and electrochemical direct current methods (polarization), have been carried out in 1M NaCl solution.

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NANO-37

Process Engineering of Vapour Deposited Conducting Polymers for Electrochemical and Sensing Applications

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Conducting polymers (CPs) are relatively new class of materials with attractive properties and behaviour that can include high electrical conductivity and optical transparency, electrocatalytic behaviour, mechanical flexinlity, light weight etc. Of the many CPs that have been studied, poly(3,4-ethylenedioxythiophene) (PEDOT) has been the polymer showing the greatest commercial potential. To a large extent this has been due to the polymer's chemical and environmental stability as well as high conductivity and large optical transmission changes that can be achieved with redox switching. (1,2) Since the discovery of CPs in the 1970's, studies related to CPs have been mainly focused on developing facile synthesis processes for producing CPs with enhanced properties (electrical, electrochromic, electrocatalytic, etc.) primarily on planar substrates. In this work we present the development of a vapour deposition for PEDOT on non-planar substrates. In particular the process engineering of the precursor oxidant solution to generate PEDOT on carbon paper (for batteries, supercapacitors) (3) and optical fibres (for biosensing). Our Initial results have shown that varying the viscosity/solvent evaporation rate of the oxidant solution and incorporating sacrificial nano-templates, high surface area PEDOT can be generated. The resultant hollow nano-spheres of PEDOT are demonstrated useful for energy storage devices.

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