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ZnO NANOSTRUKTŪRU IEGŪŠANA, TERMISKI OKSIDĒJOT Zn PLĀNĀS KĀRTIŅAS

ZnO nanostruktūras tika sintezētas uz stikla pamatnēm ar divu soļu tehnoloģiju – Zn kārtiņu uzputināšanu un termisko atkvēlināšanu. Sākumā uz stikla pamatnēm tika uzputināta plāna Zn kārtiņa ar magnetronu uzputināšanas metodi, lai palielinātu kārtiņas adhēziju. Tad uz šīm kārtiņām ar termiskās uzputināšanas metodi tika iegūts apmēram 550 ±10 nm biezs Zn slānis. Tika iegūti paraugi ar dažādu termiskās uzputināšanas ātrumu un līdz ar to arī atšķirīgu virsmas morfoloģiju. Termiski oksidējot šos paraugus, tika sintezētas adatveidīgas ZnO nanostruktūras. Izaugušo ZnO nanoadatu diametrs bija ap 20 – 80 nm, bet garums svārstījās no 20 nm līdz pat vairākiem mikroniem. Tika izpētīts, ka Zn plāno kārtiņu uzputināšanas ātrums ietekmē ZnO nanostruktūru veidošanos, atkvēlināšanas rezultātā. Ar skenējošā elektronu mikroskopa un rentgendifraktometra palīdzību tika pētīta ZnO plāno kārtiņu paraugu virsmas morfoloģijas un struktūras īpašību atkarība no tā, ar kādu no uzputināšanas metodēm tika iegūtas Zn plānās kārtiņas.
Šāda veida nanostrukturētas virsmas var tikt pielietotas gāzes sensoros, saules elementos un sagatavēs, kur nepieciešami lieli virsmas laukumi.

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ПОЛУЧЕНИЕ НАНОСТРУКТУРНЫХ ОБРАЗОВАНИЙ ОКСИДА ЦИНКА МЕТОДОМ ТЕРМИЧЕСКОГО НАПЫЛЕНИЯ ЦИНКА С ПОСЛЕДУЮЩИМ ОТЖИГОМ

Исследован процесс образования наноразмерных структур ZnO методом термического напыления Zn в вакууме на стеклянные подложки и последующим отжигом. На подложки наносился адгезионный слой для улучшения сцепления термически нанесенного материала со стеклом. Получены хаотически расположенные по поверхности подложки наноструктурные образования ZnO (нити, иглы) и качественно исследован их рост при использовании различных материалов (Cu, CuO, Zn, ZnO) в качестве адгезионного слоя. Установлено, что наибольшая концентрация и размер у наноструктурных образований ZnO выращенных на слое Zn, нанесенного магнетронным методом.

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FIBERCONCRETE WITH NON-HOMOGENEOUS FIBERS DISTRIBUTION

In this research fiber reinforced concrete prisms with layers of non-homogeneous distribution of fibers inside them were elaborated. Fiber reinforced concrete is important material for load bearing structural elements. Traditionally fibers are homogeneously dispersed in a concrete. At the same time in many situations fiber reinforced concrete with homogeneously dispersed fibers is not optimal (majority of added fibers are not participating in load bearing process). It is possible to create

constructions with non-homogeneous distribution of fibers in them in different ways. Present research is devoted to one of them. In the present research three different types of layered prisms with the same amount of fibers in them were experimentally produced (three samples with dimensions 100×100×400 mm were created for each type and four prisms with homogeneously dispersed fibers were produced for reference as well). Prisms were tested under four point bending conditions till crack opening in each prism reached 6 mm.

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ENCAPSULATION OF IRON OXIDE NANOPARTICLES INTO THIN FILMS BY DIP-COATING METHOD

This study present production of SiO_2/Fe_xO_y thin films by encapsulation of iron oxide nanoparticles between two SiO_2 layers.

Magnetic nanoparticles Fe_3O_4 were prepared using coprecipitation method. An argon flux was used to deoxygenate water to prevent Fe^{2+} oxidations. Black precipitate was producted by coprecipitation in alkaline media with a molar ratio of $Fe^{2+}/Fe^{3+} = 0.5$.

The SiO_2/Fe_xO_y films consist three layers on a glass substrate. The first and third layers are a SiO_2 layer prepared by dip-coating from tetraethylortosilicate solutions and subsequent calcination at 500°C temperature. The second layer was prepared by dip-coating from the aqueous colloidal dispersion of previously synthesized magnetite. In order to prevent the conversion of magnetite to maghemite or hematite heat treatment of the magnetite composition is carried out in an inert or reducing environment. The glass substrates were initially treated with CeO_2 water suspension or etched by H_2SO_4 in order to obtain a clean and rough surface.

Structural and morphological characteristics of iron oxides particles and prepared film have been characterized by X-Ray Diffraction, SEM, FTIR, DTA, AFM.

The calcined films reported here exhibit crack-free morphology, consisting of aggregated silica/magnetic nanoparticles, with a final average size of c.a. 100 nm.

AFM topography of surface and measurements of roughness has shown that using iron oxide encapsulation between two SiO_2 layers to provide the even distribution of iron oxide, results as high quality films with low R_q values 1.5 – 2.7 nm.

Future controlled advancement of this method could provide a low cost solution for mechanically stable composite thin films with various, technologically useful, properties.

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DESTRUCTION OF COMETS

Key words: comets, destruction, astronomy, Solar system, Earth

The aim of the work is to research phenomeon that can cause partial or complete decay of comets. Scenarios of erosion of comets have been viewed and theoretically modelled in this study, applying approximations within the Solar system. Researches in this field are actual, especially nowadays, due to the fact that astronomers have been observing increased number of comets and asteroids in the Solar system, especially in proximity from Earth, for a few decades already. A work with information sources : books, publications, Internet material; calculations has been done during the research, modelling before mentioned situations within the Solar system. An in-depth study of this topic can serve as a basis for developing a method of prediction for dynamic evolution of comets.