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тау-кен металлургиялық кешенді дамытудың түйінді мәселелері» атты
IX Халықаралық конференциясының

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«Материалтануға және наноматериалға арналған
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20-23 мамыр

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IX Международной конференции

«Эффективное использование ресурсов и охрана окружающей среды –
ключевые вопросы развития горно-металлургического комплекса»

и

XII Международной научной конференции

«Перспективные технологии, оборудование и аналитические системы
для материаловедения и наноматериалов»

20-23 мая

MATERIALS

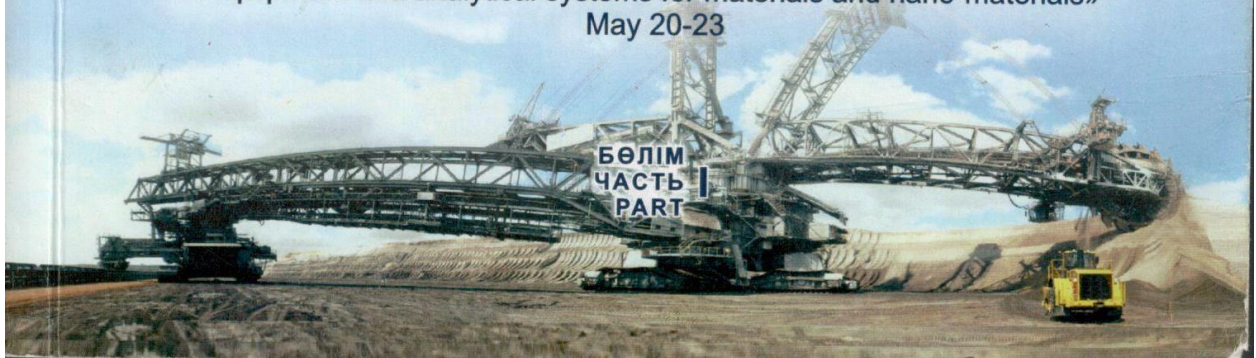
of IX International conference

"Efficient use of resources and environmental protection - key issues
of mining and metallurgical complex development"

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XII International science conference «Advanced technologies,
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**MOCVD SINTEZ NANORAZMERNYKH GETEROEPITAKSIAL'NYKH PLENOK SiC NA
PODLOZHKAH KREMNIYA I SAPFIRA DLYA PRIMENENIYA V KACHESTVE
PODLOZHECHNOGO MATERIALA NITRIDNYKH SVETODIODOV
[SYNTHESIS OF NANOSCALE HETEROEPITAXIAL SiC FILMS ON SILICON AND SAPPHIRE
SUBSTRATES BY MOCVD FOR USING AS A SUBSTRATE MATERIAL NITRIDE LEDS]**

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Abstract

Purpose - In this paper nanoscale heteroepitaxial films SiC have been deposited on Si(100), Si(111) and sapphire(0001) substrates by metal-organic chemical vapor deposition (MOCVD).

Methodology - Diethylmethylsilane (DEMS) has been used as a single precursor, which contain Si and C atoms in the same molecule, without any carrier or bubbler gas. The synthesis of SiC heteroepitaxial films has been conducted, by photo-assisted process, which was achieved by using high light intensity gallogen lamps. The deposition has been conducted at temperatures in the range of 800-1100°C, and at various deposition time and volume of DEMS precursor flow supply to the stainless steel vertical vacuum chamber with high temperature sample heater coated by boron nitride ceramic.

Originality/Value - It is important that the MOCVD method using DEMS as a single source precursor enables to obtain homogeneous, nanocrystalline epitaxial β -SiC films at a temperature of 850°C. XRD spectra for SiC films deposited at 850°C and 900°C on Si(111) and on sapphire (0001) substrates respectively. An intense reflection peak of 3C-SiC(111) was observed at $2\theta = 35.7^\circ$, indicating that the deposited β -SiC film has a single phase cubic structure on Si(100), Si(111) and sapphire(0001) substrates.

Findings - It has been established the orientation of Si and sapphire substrates does not specify the orientation of the grown film. However, Raman spectroscopy results present that increasing of deposition temperature till 1000°C occurs of rebuilding of the lattice structure to hexagonal 6H-SiC polytype on silicon and sapphire substrates, and it is led to formation mixtures of polytypes. It is suggest, that during the formation of the crystal structure of SiC the temperature of substrate is main factor. XPS analysis of the chemical composition and depth profile of SiC films deposited at 900°C and 1000°C on the substrates Si(100) and a sapphire(0001) with a thickness from 50nm to 200nm is achieved using an etching of film surface with ions Ar⁺, the measurements of XPS spectra have been carried out after 2 minutes and 4 minutes treatment. The surface treatment by accelerated Ar⁺ ions has been shown that after 2 minutes, the elemental ratio of SiC films deposited at 900°C and chamber pressure 50mTorr is close to the stoichiometric concentration with a slight predominance of carbon.

Key words - Silicon carbide, substrate, heterostructure, film.

Введение

Карбид кремния привлекает внимание исследователей для применения в создании различных оптических устройств. Несмотря на то, что SiC является непрямозонным полупроводником, при добавлении различных примесей, он способен люминесцировать по всей видимой области спектра. В последнее время соединения нитридов III группы привлекают много внимания со стороны исследователей, будучи прямозонными полупроводниками, нитриды III группы имеют, более высокий квантовый выход, чем SiC, что делает их идеальными материалами для фотонных устройств в диапазоне синего цвета и УФ. Однако они не имеют своих подложек, и их рост осуществляется на подложках сапфира или карбида кремния. Подложки из SiC идеально подходят для роста GaN светодиодов, так как разница между параметрами решетки SiC и GaN очень низкая (3%). Приборы на SiC долговечны и технологичны в изготовлении. В области силовой и быстродействующей электроники наибольший интерес представляют эпитаксиальные структуры на его основе; в СВЧ-электронике повышенной мощности одними из перспективных являются композиции гетероструктур GaN/AlN/SiC; в оптоэлектронике особый интерес представляют структуры GaAlN/SiC,

Соль мне внимания