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ABSTRACT BOOK

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[15.1.06]

Effects of plasma hydrogenation on low temperature growth of nanocrystalline cubic SiC thin films

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Silicon carbide (SiC) is considered as one of the alternative power semiconductor materials due to its excellent properties such as wide band gap, high breakdown field, and high thermal conductivity. Another unique property of SiC is its poly-types. 3C-SiC (ß-SiC) having a cubic crystal structure is suitable for high-frequency power devices due to its high electron mobility and high electron-saturation-velocity. Moreover, the limited leakage current resulting from the larger bandgap of ß-SiC is an advantage compared to Si. Such a characteristic is employed in bipolar transistors, solar cells, photodiodes and phototransistor and has stimulated extensive research interest. Recently, many techniques have been employed to deposit ß-SiC thin films and chemical vapor deposition (CVD) is thought to be a possible technique to fabricate high-quality ß-SiC thin films. However, the high deposition temperature during CVD may cause autodoping, redistribution of dopants in the Si substrate, and also results in high tensile stress and lattice defects. Generally, it is recognized that enhancing the activity of the precursors is beneficial to the reduction of the substrate temperature. In this work, by means of plasma hydrogenation, ß-SiC thin films were fabricated on Si (100) substrates at lower substrate temperature in a CVD system, and the effects of plasma hydrogenation on low temperature growth of nanocrystalline cubic SiC thin films were investigated in details. Our results indicate that plasma hydrogenation is an effective method to decrease the deposition temperature and improve the composition and microstructure of ß-SiC thin films, especially by controlling the crystal particle size and oxygen diffusion. The enhancement mechanism can be explained by a charge-selecting reaction model.

Keywords: Silicon carbide, plasma hydrogenation

[15.1.07]

The RF plasma surface chemical modification of nanodiamond grown on glass at low temperature

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Nanodiamond thin films have excellent electrochemical properties, low roughness and can be deposited at relatively low temperatures below 400°C on glass over large areas using microwave chemical vapour deposition (MW CVD) in a hydrogen-methane plasma [1]. The surface chemistry derived properties of nanodiamond are as remarkable as its bulk properties, and the chemical modification of the nanodiamond surface enables the development of new applications, for example nanodiamond-covered microscopic slides of the standart 1×3" size with surface functionalized for biochemical applications.

Since the diamond surface is generally inert to most chemical reagents, the controlled chemical modification of the diamond surface has proved difficult. Until now, diamond surface research has mostly been focused on hydrogenated or oxidized surface. We have applied radio-frequency (RF) plasma discharge in various processing gasses to chemically modify nanodiamond thin films, deposited on silicon or glass substrates. The stable, reproducible, high density and homogeneous chemically modified surfaces have been achieved.

The presence and the relative density of the primary amines group (-NH2) attached to the nanodiamond surface was detected by photo-luminescence, using fluorescamine-in-aceton spray as a fluorescence marker [2]. In this paper, the grafted-surface vibration spectrum was investigated by grazing angle FTIR spectroscopy, photoaccustic spectroscopy, attenuated total reflectance spectroscopy and photothermal deflection spectroscopy to identify all attached species. Finally, our plasma-aminated nanodiamond-coated microscopic slides were compared with standard biochip slides for DNA hybridization.

References:

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Keywords: Functionalization, optical properties, surface, nanodiamond

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[15.1.08]

Investigation of nanocrystalline diamond films grown on silicon and glass at substrate temperature below 400°C

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The efforts in growth of nanocrystalline diamond (NCD) thin films have been intensified in the recent years. NCD thin films offer optimal properties because of its smooth surface and excellent, homogenous mechanical and thermal properties, approaching to single crystal value[1]. However, deposition of NCD layers at low temperature range (i.e. 400°C and lower) is required by several industrial applications.