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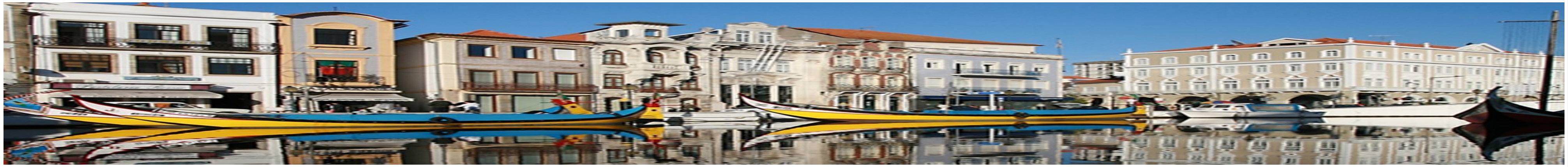

Structure and morphology of SiC nanostructures synthesized on Cu films

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INTRODUCTION

Recently, one-dimensional (1D) semiconductor nanostructures (wires, rods, belts, and tubes) have become the focus of intensive research, owing to their unique application in the fabrication of electronic, optoelectronic, and sensor devices on a nanometer scale. So far, many kinds of 1D semiconductor nanomaterials have been successfully synthesized by a rich variety of methods[1,2]. Among these semiconductor nanowires, SiC has very unique properties, such as wide bandgap, excellent thermal conductivity, chemical inertness, high electron mobility, and biocompatibility, which promise well for applications in microelectronics and optoelectronics, and has thus attracted much interest from the materials and devices communities[3,4].

EXPERIMENTAL STUDY

The porous and polished silicon wafers with orientation [100] and [111] were used as substrates and basis for copper films. The substrates were previously chemically cleaned. The treatment was carried out in a mixed solution of NH_4OH, H_2O_2 and dis-tilled water at a volume ratio of 1: 1: 6.5, at a temperature of 20°C for 10 minutes, using sound waves with a frequency of 850 kHz, power 250 Watts. Further, washout in distilled water and drying were performed. Copper films were deposited on substrates of polished silicon wafers by DC magnetron sputtering in equipment VUP-5M. Sputtering was carried out in the flow of working gas Ar at a pressure of 10-2 Torr. The flow rate of Ar was 6 cm3/min and it was controlled by the gas flow controller MCV-500SCCM. Experiments were conducted at a constant voltage on the anode target (740 V), the plasma current of 35 mA. The time of experiments was 5 minutes.

Synthesis of nanostructures was carried out in the Department of Surface and Technology of New Materials at the Institute of Materials Science, University of Siegen (Germany), on equipment of microwave plasma assisted chemical vapor deposition (MWCVD) of the ASTEX system (frequency 2.45 GHz). Prior to the experiments, the substrates were purified with ethanol and then washed with distilled water, drying was carried out at room temperature. The synthesis temperature ranged from 700 to 900 °C in steps of 100 °C. The temperature was measured using an infrared pyrometer of model Chino IR-AP M0011 (Japan). The experiments were carried out at three plasma power levels of 1800, 2000 and 2200 W. The pressure in the chamber was changed depending on the power of the plasma. Table 1 shows the parameters of the experiments. The mixture of trimethylsilane ($(CH_3)4Si$) and hydrogen was used as working gas, the flow rates of which were 10 and 400 cm^3 /min, respectively. The duration of the experiments was 120 min.

RESULTS AND DISCUSSION

Studies by the method of scanning electron microscopy have shown that the formed nanostructures have a diameter of 200–350 nm and a rough surface. The formation of nanostructures on polished Si occurs on the SiC buffer layer. The height of the SiC film decreases with increasing substrate temperature. Analysis of SEM images of the samples shows that the growth of nanostructures on the porous surface is more massive than on polished Si. The results of studies by Raman scattering confirmed that SiC film with structure of 3C-SiC is formed on the polished Si. Besides, the presence of main carbon peaks on both types of substrates in the range of 1338.2 and 1583 cm^{-1} should be noted, which correspond to the carbon nanostructures.

CONCLUSION

It is necessary to conduct additional studies using transmission electron microscopy and diffraction of electrons for a more detailed analysis of the structure of the produced nanostructures.

REFERENCES

1. Chang CY, Chi GC, Wang WM (2006) Electrical transport properties of single GaN and InN nanowires. J. Electron. Mater. 35:738–743
2. Yang J, Liu TW, Hsu CW (2006) Controlled growth of aluminium nitride nanorod arrays via chemical vapour deposition. Nanotechnology 17:S321–S326.
3. Ruff M, Mitlehner H, Helbig R (1994) SiC devices: Physics and numerical simulation. IEEE Trans. Electron. Devices 41:1040–1054
4. Cicero G, Catellani A, Galli G (2004) Atomic control of water interaction with biocompatible surfaces: The case of SiC(001). Phys. Rev. Lett. 93:016102–016105

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