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HE Abstracts

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Synthesis of fullerene and its derivatives by plasma chemical deposition method

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INTRODUCTION

The tremendous growth of technologies and application of fuel cells show that the fuel cell technology based on hydrogen fuel cell is well developing technology. The discovery of fullerenes leads for many their applications in biology and medicine[1-2], hydrogen storage[3-4], solar cells[5-6] and etc. The advantage of using fullerene for hydrogen storage application is high purities of fullerene preparation, possibilities of doping alkali, alkali-earth atoms and transition metal on fullerene and avoiding clustering of fullerenes due to the their surface curvature[4]. In this work the synthesis of fullerene and its derivatives by plasma chemical deposition method are considered.

EXPERIMENT

The synthesis of fullerene was carried out in plasma of arc discharge at inert gas. The following parameters were used for plasma chemical cathodic arc deposition method: pressure of gas 300 Tor, voltage 30 V and current 300 A. The products of plasma chemical reaction were carbon deposited on the reactor wall and deposit material on cathode electrode. Purification of fullerenes was made by dissolving the obtained carbon black in benzene solution for 12 h, then drying of solution at room temperature after filtration.

RESULTS AND DISCUSSION

Obtained samples were studied by scanning electron (SEM) and probe (SPM) microscopies and transmission electron microscopy (TEM). It was found, that deposit material consists of thin graphite sheets, carbon nanotubes, graphite rings, peapods and cones. The some of the graphite sheets have 1-4 layers of graphene.

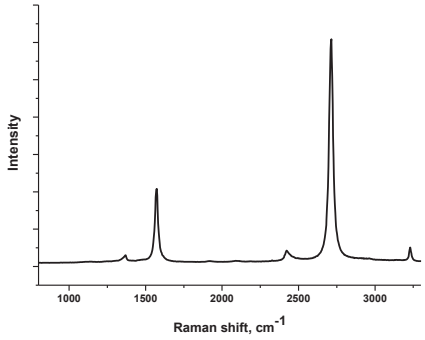

Fig. 1 Raman spectra of thin graphite sheets on deposit material

Obtained samples precipitate crystals after dissolving carbon black in benzene solution and drying were identified as fullerite.

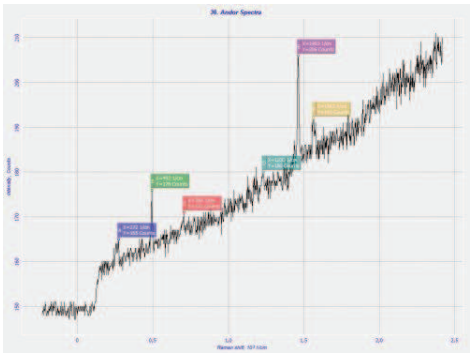

Fig. 2 Raman spectra of fullerene C_{60} and C_{70}

The peak at 272 cm^{-1} is Hg symmetry mode of fullerene C_{60}. The intensive peaks at 492, 1463 cm^{-1} and weak peak at 704 cm^{-1} correspond to pentagonal pinch modes of fullerene C_{60}. The other intensive peaks at 1567 cm^{-1} and 1230 cm^{-1} correspond to vibration modes of fullerene C_{70}.

CONCLUSION

In this work the fullerene and its derivatives were synthesized by plasma chemical deposition method. Obtained samples were studied by using of SEM, SPM and TEM microscopies.

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