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Influence of dispersion of catalytic carrier for growth mechanism of carbon nanotubes

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INTRODUCTION

Composites based on carbon nanotube (CNT) have a good application in a wide range of industries: electronics¹, construction², medicine³, energy⁴, aerospace and automotive industries⁵ and etc. The main purpose of any industry is to increase the quality and quantity of products. In this work, an influence of dispersion of catalytic carrier is considered for increasing the quantity of carbon nanotubes at synthesis chemical vapor deposition (CVD) process in fluidized bed reactor.

EXPERIMENTAL

Experiments were carried out in fluidized bed reactor by CVD method. Two dispersions of catalytic carrier were used – zeolite microparticles with lower dispersion ~ 10-220 μm and higher dispersion ~ 1-5 μm. Zeolite powder with different dispersions were obtained by mechanical and plasma separation processes⁶. Catalytic nanolayer was prepared by wet impregnation method of powder in 0,1M water solution of nitrates of nickel and cobalt⁶. The CVD synthesis were carried out at 800°C in atmosphere of hydrogen gas with ethanol vapor.

RESULTS AND DISCUSSION

Obtained samples were studied by scanning electron microscopy and Raman spectroscopy. It was found that samples of zeolite powder with lower dispersion almost don't have a presence of CNTs (Fig. 1), where the samples of zeolite powder with higher dispersion have a deposition of CNTs (Fig. 2). Raman spectrum of sample with CNT (Fig. 3) corresponds to spectrum of multiwalled CNT.

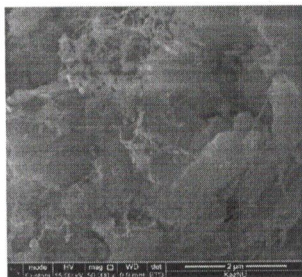


Fig. 1 Morphology of zeolite microparticles with lower dispersion after CVD synthesis process

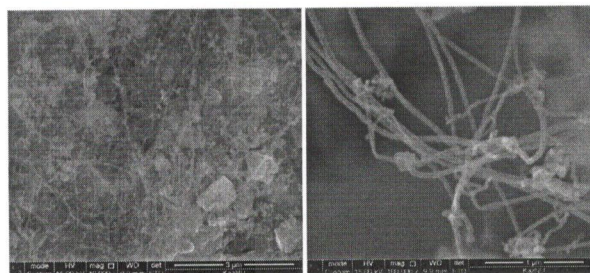


Fig. 2 Morphology of zeolite microparticles with higher dispersion after CVD synthesis process

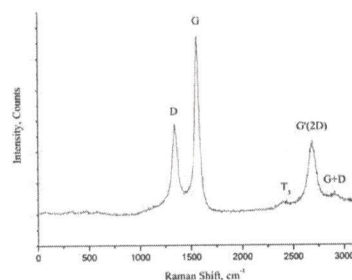


Fig. 3 Raman spectrum of multiwalled CNT grown on zeolite microparticles with higher dispersion

CONCLUSION

Obtained results show that the dispersion of catalytic carrier plays an important role in CVD synthesis of CNTs in fluidized bed reactor.

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