

Synthesis of high quality single-wall carbon nanotubes by CCVD method

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YRD-Centre Ltd carries out research work in the field of development of a highly capacity synthesis SWCNTs by a catalytic chemical vapour deposition (CCVD) methods with use floating catalyst

This work is dedicated to optimization of technological parameters of synthesis with use such quality analysis methods of SWCNTs as: TEM, SEM, and Raman spectroscopy.

All experiments were spent on vertical type set-up with use of the flow reactor, power system of a reaction mix and carrier gases, and collection systems of the carbon material on reactor outlet. As a carbon precursors used a methanol, ethanol, n-propanol, isopropyl alcohol, and hexane; catalyst precursor – ferrocene ($\eta^5\text{-C}_5\text{H}_5$)₂Fe; activator of growth SWCNTs – thiophene C₄H₄S; carrier gas – hydrogen, argon. The reaction time was varied from 0.1 to 3 hr at temperature 850-1200°C. All experiments was led to formation of black fibrous material consist of SWCNTs and metal particles. The best results were reached for the reaction mixes based on ethanol. Characterization of synthesis products with TEM, SEM and Raman spectroscopy showed that it is dominated by SWCNTs with relatively narrow size distribution and missing amorphous carbon. The absence of amorphous carbon in the product makes final purification much easier.

It is necessary to note that high quality SWCNTs was achieved by combination of such technological parameters as: composition and flow rate of feed-stock and carrier gas, methods of reaction mix input in synthesis zone, and synthesis temperature.