

Komitet Mechaniki Polskiej Akademii Nauk

Politechnika Rzeszowska  
im. Ignacego Łukasiewicza

Instytut Podstawowych Problemów Techniki  
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III KRAJOWA KONFERENCJA

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## **CARBON NANOTUBES SYNTHESIS BY THE Nd:YAG LASER ABLATION PROCESS**

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Laser ablation is a well-established method of obtaining a wide variety of carbon-containing materials, such as diamond-like carbon thin films [1], fullerene carbon molecules [2] and carbon nanotubes [3]. In this work we present preliminary results of synthesis of carbon nanotubes by the Nd:YAG laser vaporization method.

The reactor for synthesis of carbon nanotubes assembled in the Institute of Fundamental Technological Research is shown in Fig.1. The ablation of the target occurs in a background gas – argon at a pressure of 660 Pa slowly flowing in a quartz tube 50 mm in diameter. The quartz tube is mounted inside a cylindrical furnace operating at 1000° C. The target is situated in the centre of the furnace. Graphite target irradiation was performed using the pulsed Nd :YAG laser (Quantel, 981 E). The laser was operated at a wavelength of 1064 nm with fluence below 3 J cm<sup>-2</sup> and 10 ns pulse duration with a repetition rate of 10 Hz. The argon flow rate was 200 sccm. The graphite target contained cobalt and nickel nanoparticles used as carbon nanotubes synthesis catalysts. Graphite target was fabricated using graphite powder (GP, 99,9%, Korea) vigorously mixed with a water solution of (CH<sub>3</sub>COO)<sub>2</sub>Ni and CoCl<sub>2</sub> precursors. Solution of NaBH<sub>4</sub> (1 M) was used as reducer of Ni and Co salts. Metallic nanoparticles (with diameter of 10-40 nm) were successfully deposited on the GP surface in a ratio: 0.5 at% Ni and 0.5 at% Co. The mixture was pressed under high pressure at room temperature into tablet 25 mm in diameter. The carbon soot containing nanotubes was collected from the surface of the brass water-cooled collector located at the exit of the furnace. Fig.2 shows the SEM image of the collected soot with carbon nanotubes.



Fig.1 Reactor for synthesis of carbon nanotubes. In the centre of the furnace - inspection window. On the left side of the furnace the brass collector and the mechanism for target rotation.

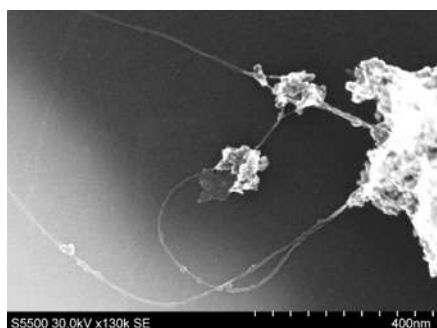


Fig.2 The SEM image of the collected soot with carbon nanotubes.

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