Fullerenes production by electric arc pyrolysis of methane in a three-phase ac plasma torch

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The present work deals with a high-voltage three-phase ac plasma torch working as a part of a plasma-chemical facility. This plasma torch consists of three electric arc channels and three rod copper electrodes. The initial breakdown occurs with high voltage (10 kV) provided by a high voltage power supply. The electric arc plasma oxygen-free pyrolysis of methane was realized on the facility. The fullerene-containing fraction was extracted from the carbonaceous material by extraction with ortho-xylene. Nanocarbon material with submicron particle sizes was produced by the method of oxygen-free electrical arc pyrolysis of methane. The resulting carbon black contained particles of graphite (66%) and amorphous carbon (34%), as well as light fullerenes in amounts up to 3%. Infrared spectroscopy showed reflexes typical of C–C bonds in graphite and C–H in polynuclear hydrocarbons. The spectrum is characterized by some peaks in the near uv region, in particular, $\lambda = 337 \pm 2$ nm, characteristic of light fullerenes. X-ray diffractometry showed the presence of graphite and amorphous carbon. On these grounds it can be assumed that this method can be applied as a low-cost and effective method for the synthesis of fullerenes.