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Arc pyrolysis of methane in argon atmosphere

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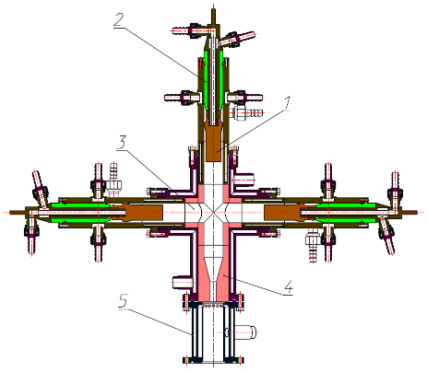
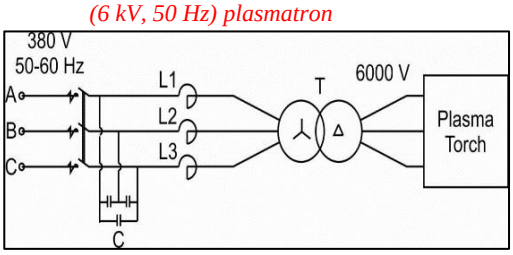
Installation with a three-phase arc plasmatron AC

Graphite lined electric arc pyrolyzer



High voltage power supply circuit (6 kV, 50 Hz) plasmatron



A high-voltage power supply (6 kV, 50 Hz) consists of three current-limiting reactors, a reactive power compensator, a step-up transformer, and a system for measuring and recording electrical parameters

- Production of fullerenes from hydrocarbons;
- Production of fullerenes from hydrocarbons;
- Using AC 50 Hz;
- The possibility of a significant increase in carbon concentration in the high-temperature zone (injection of fine particles of graphite).

1 – graphite electrodes, 2 – PTFE insulator, 3 – electric arc channels, 4 – graphite lining, 5 – water cooler

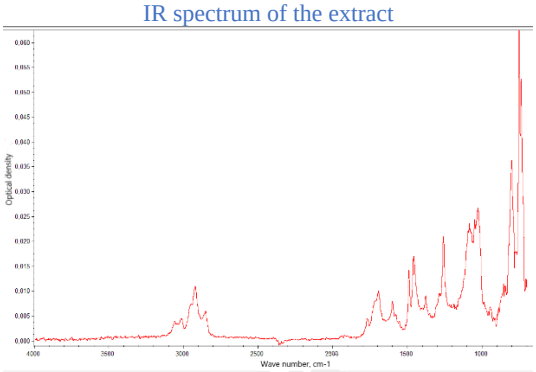
- Electric power 10 kW (thermal efficiency - 95%);
- Argon consumption -3.0 g/s (in the arc burning zone) and 0.5 g/s (in the near-electrode zone);
- The installation worked on methane and argon;
- Methane consumption - 0.1 g/s (carrier gas supplied to the arc zone)

$$60CH_4 + 60O_2 = C_{60} + 120H_2O$$

Experimental conditions

№	Electrode	Hydrocarbon	Consumption of hydrocarbon, g/s	Uab, B	Ubc, B	Uac, B	I, A	P, kWt
1	Cu	Methane	0,05	105	271	274	27,8	9,26
2	Cu	Propane	0,1	130	227	233	27,5	8,41
3	C	Methane	0,05	111	320	303	31,6	12,28
4	C	Propane	0,06	114	222	223	31,6	9,23
5	C	o-xylene	0,05	132	144	187	31,7	7,4

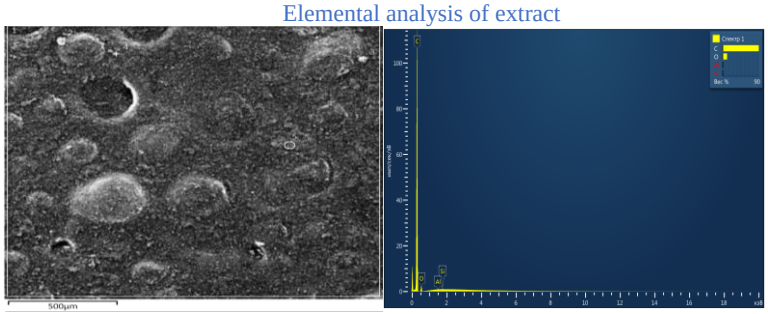
IR spectrum of the extract



The spectra show that the soot contains various hydrocarbons (bands in the range of 2800–3100, 600–800, 1300–1600 cm – 1), which indicates the incompleteness of decomposition of hydrocarbons into carbon and hydrogen.

It can be concluded that there are various polycyclic aromatic hydrocarbons (naphthalene, phenanthrene, fluorene, benzpyrene, etc.).

Elemental analysis of extract



Carbon amount varies from 89 to 97%. There is oxygen everywhere (from atmosphere).

Conclusion: a fullerene-containing mixture was obtained and passed the elemental analysis study. The obtained carbon black extract was examined by IR spectroscopy.