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# Application of carbon nanotubes to protect plasma torch electrodes

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The lifetime of plasma torch electrodes is critical, however, it is usually limited to 200 hours. Here we report a direct current arc plasma torch with cathode lifetime significantly exceeded 1000 hours. To ensure the electrodes' long life a process of hydrocarbon gas (propane/butane) dissociation in the electric arc discharge is used. In accordance with this method, atoms and ions of carbon from near-electrode plasma deposit on the active surface of the electrodes and form a carbon condensate in the form of carbon nanotubes. It operates as an "actual" electrode.

To realize aforesaid the construction of a plasma torch using air as the plasma forming gas has been developed and tested. For long-term electrode operation, carbon nanotubes are ideal materials. They have high electron emission and are chemically inert at high electric field strengths. Carbon nanotubes' conductivity is superior to all conventional conductors, they can withstand current density 100 times greater than metals, and they have high heat conductivity. They are very mechanically firm, 1000 times more firm than steel and they gain the properties of semiconductors at their curling or flexion.

On the basis of atomic force microscopy, scanning electron microscopy, transmission electron microscopy and Raman-spectroscopy investigation it was concluded that the cathode condensate consists mainly of single and multi-walled carbon nanotubes and other nanoforms. The lifetime of the reported cathode totals more than 1000 hours. The experiments reported here confirm the possibility for an unlimited lifetime of the cathode coated with composite nanocarbon layer.

## Biography

AB Ustimenko has completed his PhD Combustion problems Institute, Research Institute of Experimental and Theoretical Physics. He is the director of Research Department. He has published more than 100 papers. He also has been serving as board member for a few more companies.

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