Abstract Submitted
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Self-organized electrode processes in the carbon arc discharge for nanotube synthesis[1] JONATHAN NG, YEVGENY RAITSES, PPPL — The atmospheric pressure carbon arc in helium is an important method for nanotube production [1]. Typical arcs operate in a dc mode between a graphite anode, which is consumed, and a lower melting temperature cathode (e.g. copper [2, 3]). It is accepted that electrons from the cathode are emitted by thermionic field emission [2,4], requiring the cathode to be above the melting temperature of its material. Yet, the cathode usually remains undamaged by the arc, raising the question about how the electron current in the arc is supported. Our experiments with copper, stainless steel and aluminum cathodes have revealed that thermo-field emission is the source of most of the arc current at the cathode, but emission is from the carbon deposit formed on the cathode in the course of the arc operation. Due to its low heat conduction, the cathode does not reach its melting temperature and remains undamaged. The evaporation of the graphite anode and formation of the carbon deposit on the cathode are self-organized to maintain the current conduction in the arc.

[1] Journet et. al. Nature 388:756 (1997)
[2] Keidar and Beilis, J. Appl. Phys 106, 103304 (2009)
[3] Fetterman et al, Carbon 46, 1322 (2008)
[4] Hantzsche, Beitr. Plasmaphys., 22, 325(1981)

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