FLASH INDUCED GRAPHITIZATION ON AMORPHOUS CARBON FIBERS

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Key Words: Flash; Carbon Fibers; Graphitization; Thermal Treatment; Electrical Conductor

It has been shown that an electric field higher than 3 $V.cm^{-1}$ when applied on amorphous carbon fiber from pitch precursor (P-30X from Thornel) at temperatures higher than its Debye temperature (~1000ºC) can lead to *flash* of the fiber promoting its graphitization. Although the carbon fiber is an electrical conductor, it is only after a specific combination of electric field and temperature that the *flash* signatures could be observed, as it conventionally happens with insulators. In this experiment, bundles with an average of 300 filaments (10µm in diameter each) were heated up to 1000ºC in an argon atmosphere and then electric current was applied in a current density rate of 50 $A.mm^{-2}.min^{-1}$ until different current limits, 25, 50, 75, 100, 125, 150 and 175 $A.mm^{-2}$, were attained. According to the black body radiation estimative the maximum temperature of the fibers due Joule heating was 1500ºC. When the fibers exceeded 1100ºC some electroluminescence was detected, and their electrical conductivity increased abruptly reaching 2.10^5 S.m, which is close to monocrystalline graphite. Both, electroluminescence, and electrical conductivity increase, are well known *flash* signatures and are accompanied by phase change, here seen as graphitization of the carbon fibers. In order to quantify the structural modifications through XRD analysis, 40 wt% of crystalline Si was added as internal standard to the grounded carbon fibers, and the integrated intensity of the carbon peak against the silicon peak was compared. The graphitization was found to be dependent on the current density limit, reaching similar C/Si ratio as pure crystalline graphite for current densities higher than 100 $A.mm^{-2}$. The interlayer spacing, d_{002}, decreased from 0.35 nm to 0.34 nm, which corresponds to the generation of turbostratic graphite, usually obtained when the fibers are treated at temperatures higher than 2500ºC. Also, crystallite dimension, *Lc*, increased from 42 Å to 142 Å. These findings present a new way to treat carbon fibers and give a new perspective on *flash*, since it was achieved in an electrical conductor with all the common *flash* signatures usually seen in ceramics.