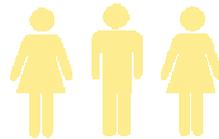


SEMINAIRE SACM

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11 H 00 Eric Minoux
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Salle André Berthelot, Bât.141

Carbon Nanotube Cold Cathodes for Microwave Applications



Electron tube based amplifiers, including travelling wave tubes (TWTs), use an amplification process which resides in an energy transfer between a modulated electron beam and an electromagnetic wave delayed by a slow-wave structure, e.g. an helix. In conventional TWT based on thermionic cathodes, 2/3 of the helix is devoted to modulate the primary continuous electron beam. By integrating a cold cathode in a tube the electron emission can be directly modulated at the cathode (so the helix length is divided by 3) allowing therefore the fabrication of more compact and lighter RF amplifiers. This reduction is very attractive in spacecraft applications.

Due to their exceptional electrical, chemical and geometrical properties (in comparison with metal tips), vertically aligned carbon nanotubes (CNTs) are extensively studied as electron sources. Fabrication and growth methods combine e-beam lithography and DC plasma enhanced chemical vapour deposition (DC-PECVD). Our samples consist in $500 \times 500 \mu\text{m}^2$ arrays of vertically aligned individual CNTs with an average apex diameter of 50nm, a $5 \mu\text{m}$ height and a $10 \mu\text{m}$ pitch.

Each nanotube is able to emit a current of around $100 \mu\text{A}$ and arrays exhibit current densities compatible with TWT beam requirements ($>1 \text{A}/\text{cm}^2$). Using a RF diode configuration at 1.5GHz such an array has emitted an average current of 3.1mA and a peak current of 30mA corresponding to a peak current density of $12 \text{A}/\text{cm}^2$. A triode type device has been developed to reach higher frequencies and we have thus demonstrated for the first time at 32GHz a modulated peak current of $300 \mu\text{A}$, corresponding to a current density of $0.12 \text{A}/\text{cm}^2$.



Le café sera servi 15 minutes avant

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Tous les auditeurs extérieurs sont priés de prévenir à l'avance de leur visite : Geneviève
VERON, Tél. : 01 69 08 69 49 (UE : délai de 24h, hors UE : délai de 4 jours) .

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