Service des Accélérateurs, de Cryogénie et de Magnétisme

Vendredi

30

Juin 2006

SEMINAIRE SACM

11 H 00 Eric Minoux
(Thales Research and Technology)
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*500µm^2 arrays of vertically aligned individual CNTs with an average apex diameter of 50nm, a 5µm height and a 10µm pitch.

Each nanotube is able to emit a current of around 100µA and arrays exhibit current densities compatible with TWT beam requirements (>1A/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 12A/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 300µA, corresponding to a current density of 0.12A/cm^2.

Le café sera servi 15 minutes avant

NB : La présentation d'une carte d'identité ou d'un passeport est exigée à l'entrée du centre . 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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