

## Structural and Thermal Properties of Hot Pressed Cu/C Matrix Composite Materials Used for Thermal Management of High Power Electronic Devices

Jean-Francois SILVAIN<sup>1</sup>, Jacques SOCCART<sup>2</sup>

<sup>1</sup>Ceramic and Metal Matrix Composite, Institut de chimie de la matiere condensee de Bordeaux, France

<sup>2</sup>Research and development, Thermidrain SAS, France

### Abstract

In order to obtain materials for electronic applications that exhibit both excellent thermal conductivity and low coefficient of thermal expansion (CTE), copper matrix composites have been reinforced by short high modulus graphite fibers.. Elaboration conditions, such as mixing conditions of the short carbon fibers and the copper powder, dimension and shape of the two powders, and finally densification atmosphere, temperature, pressure and time, have been optimized. Main parameters involved in the thermal properties of the Cu/C composite materials have been analyzed and adjusted. CTE is mainly related with the carbon volume fraction; CTE ranging from 9 to 12  $10^{-6}/^{\circ}\text{C}$  can be reproductively obtained with carbon volume fraction ranging from 50% to 20%. Thermal conductivity properties are more complex and are linked mainly with 1) the porosity level inside the material, and 2) the orientation, properties and volume fraction of the carbon fibers. For short carbon fibers, thermal conductivity, perpendicular to the axes of compression, ranging from 200 to 600 W/mK have been reproductively measured associated, in the perpendicular direction, with thermal conductivity ranging from 150 to 300 W/mK.