Optimisation of Reinforcement Properties and Architecture in Continuously Reinforced MMCs for High Thermal Conductivity, Low Thermal Expansion Applications

S. Ryelandt (Sp), D. Gaude-Fugarolas, Université Catholique de Louvain, Louvain-la-Neuve (Belgium); J. Lecomte-Beckers, University of Liège, Sart-Tilman (Belgium); F. Delannay, Université Catholique de Louvain, Louvain-la-Neuve (Belgium)

Power density in electronic devices increases as an inverse power of the size of the device. Thermal dissipation has thus become a crucial issue for future developments. Heat dissipation through the base plate of the package supporting the active electronic components requires materials presenting both a high thermal conductivity and a coefficient of thermal expansion, CTE, similar to that of Si or AlN (i.e. 4 to 9 ppm/K). In addition, low density, adequate strength, and machinability are required, especially for applications in transport or aerospatial industries. A new type of aluminium matrix composites has been developed for such applications. The composites are processed by squeeze casting. For the reinforcement, use is made of an Invar-type metallic alloy optimised to be compatible with the matrix alloy. In addition, the anisotropy of the architecture of the composite plate was tailored in such a way as to obtain a high thermal conductivity perpendicularly to the plate and a low CTE parallel to the plate. The experimentally measured properties of these composites will be shown to agree with predictions of simulations by FEM.