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''Contribution to multi-physical study and characterization of ceramic materials for power electronics''

Abstract:

In the field of electrical energy conversion, the static converters allow, by the arrangement of semiconductor switching devices and their control, to manage the energy exchanges between an electrical energy source (battery, generator, etc.) and a receiver (an apparatus using electrical energy to transform it (motion, light, etc.). The energy efficiency of these switching devices is at the heart of future energy transition products and service development strategies. In particular, in the field of transport, the constraints induced by this transition guide research activities in power electronics. Thus, researchers focus on designing new static converters forms or implementing innovative materials and processes that make them more efficient or performant. In aeronautics, the most striking constraint is the relationship between the converted electrical power and the device's volume and weight, which stimulates the development of high-power density devices in limited volumes. Usually, the considered solution is to optimize the integration of several functions, in order to reduce the size of the onboard power modules. The functionalized ceramic is the elementary device that is concerned by the following proposal. Effectively, previous studies have demonstrated the benefits that could be achieved by improvements done to the metalized ceramic substrates in use in power electronics modules. Indeed, there is a need to obtain a complete characterization of such devices. The subject aims to strengthen knowledge of ceramic materials. The knowledge will be based on the experimental characterization of functionalized ceramic materials. The study will concern the relationships between ceramic microstructure characterization and macroscopic properties.