Master Thesis project

Thermal Analysis of SiC and IGBT Power Semiconductor Modules by modifying the thermal interface materials

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Packaging technology in the power modules is one of the key issues in a power electronics system, which can affect the system performance dramatically. Compact high-temperature power modules with appropriate cooling systems, are attractive to the automotive industries. Thus, a novel thermal design of a power module to achieve an adequate cooling system would be the matter of interest. Nowadays, insulated gate biopolar transistor (IGBT) module have been utilized in several industries such as electric car, wind turbine, and high voltage DC system [1]. Figure 1 shows a high power IGBT module consisting of the module and heat sink with water cooling system.

This project will focus on thermal design concept and simulation of heat dissipation from the power module (IGBT with SiC substrate) to the heat sink using Graphene film (GF) [2] with high in-plane thermal conductivity. Applying GF between the module and heat sink enhances heat spreading on the surface of the module and decreases the temperature of the hot spot. By spreading the heat effectively on the surface of the module, the ability of heat spreading in in-plane and cross-plane directions will be investigated and simulated by finite element method in COMSOL Multiphysics software.

Students with a background in power electronics, material, nanotechnology, physics or equivalent is preferred. The project will be a cooperation between Chalmers and CEVT company.

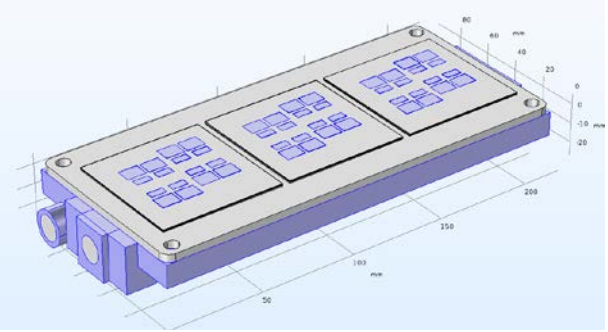

Figure 1. Schematic of the high-power IGBT module and heat sink with water cooling system.

References:

1. Bahman, A. S.; Ma, K.; Blaabjerg, F., A Lumped Thermal Model Including Thermal Coupling and Thermal Boundary Conditions for High-Power IGBT Modules. *IEEE Transactions on Power Electronics* **2018,** *33* (3), 2518-2530.

2. Wang, N.; Samani, M. K.; Li, H.; Dong, L.; Zhang, Z.; Su, P.; Chen, S.; Chen, J.; Huang, S.; Yuan, G., Tailoring the Thermal and Mechanical Properties of Graphene Film by Structural Engineering. *Small*, 1801346.

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Where to apply

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