

IGBT GEL IMPROVER

BACKGROUND

Many industrial applications make use of high voltage power electronic devices. The Insulated Gate Bipolar Transistor (IGBT) is the most common semiconductor device now used in such applications. IGBT modules that operate at voltages over 3.3kV are currently available and there is a drive to improve the power density of the module by raising voltages or by miniaturisation. A rise in voltage, and so a rise in the electric field strength surrounding the module, can cause breakdown of the insulation system of a module. The critical area in which the insulation system is extremely weak is at the edge of the metallisation of the substrate (see Figure 1). The performance of the silicone gel filling used for insulation is particularly critical in this location not just in terms of preventing electric discharge within the gel itself but also in terms of preventing discharge at the gel-substrate interface in close proximity to the metallisation.

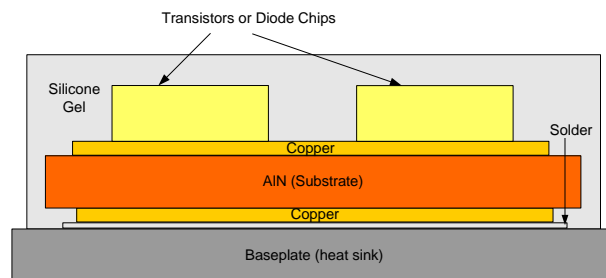


Figure 1 – Typical Power Electronic Module Cross-Section

TECHNOLOGY

Researchers at the University of Manchester have developed a novel method of reducing electric discharge at the gel-substrate interface, by inclusion of a dielectric into the gel. The inclusion of the dielectric results in a reduction in high electrical stresses that can be formed during operation at high voltages, and which can be exacerbated by other weaknesses in the module materials.

KEY BENEFITS

- Operation at higher currents, voltages or frequencies;
- More compact device, enhanced circuit integration and functionality;
- Reduction in the number of modules failing routine testing;
- At least 60% improvement seen in the partial discharge inception voltage and 40% increase in the breakdown voltage;
- Simplification of the manufacturing process.

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APPLICATIONS

High voltage power electronics devices such as IGBTs are used in a number of industries:

- Transport - automotive electrical systems, aerospace power systems, rail traction and auxiliaries, marine propulsion systems;
- Industrial - rotating machinery, process industry power supplies, pumps, fans, automation and robotics;
- Built Environment - power system conditioning and control, ventilation and air conditioning, lighting systems;
- Commercial & Healthcare - improved efficiency motor controls and drives.

CURRENT STATUS

The technology has been tested and evaluated in a commercial manufacturing environment to the required standards and has been proven to confirm the benefits of the gel improver technology. The gel improver has proven feasibility to be inserted into IGBT modules in a commercial production environment, and can be included in large scale manufacturing processes.

INTELLECTUAL PROPERTY

International Patent Application PCT/GB2009/000426 has been filed, with priority date 27.08.2009. The Intellectual Property is wholly owned by The University of Manchester.

COLLABORATION OPPORTUNITY

We are seeking to license the technology to an industrial partner, to include the Intellectual Property and associated manufacturing know-how.

CONTACT

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