
Toray and A*STAR Commence Joint Research on Adhesive Material Applications for Power Semiconductors

Singapore, September 21, 2022 – Toray Industries, Inc. and A*STAR’s Institute of Microelectronics (IME) in Singapore announced today that they have commenced joint research to develop practical applications for high heat-dissipating adhesive sheets for silicon carbide (SiC) power semiconductors.

SiC power semiconductors (see glossary note 1) offer significant energy efficiency and carbon neutrality benefits. Prospective applications include automobiles, smart grids, and data centers. In particular, from the viewpoint of further energy conservation, SiC power semiconductors are being applied more extensively for automotive applications. Compared to conventional Si, SiC has superior heat resistance, which leads to significantly improved performance by efficiently dissipating the heat generated.

Development efforts will combine Toray’s material and fabrication technologies with IME’s design, prototyping and evaluation technologies. This will improve the simplicity and reliability of processes to apply high-heat-dissipating adhesive sheets and enhance semiconductor quality, dependability, and safety. Toray and IME aim to provide comprehensive solutions to SiC device manufacturers and contribute to the uptake of high-efficiency SiC power semiconductors.

Toray will promote this joint research with support from the new Toray Singapore Research Center (TSRC, a department of Toray International Singapore Pte Ltd), which opened in Singapore in June of this year.

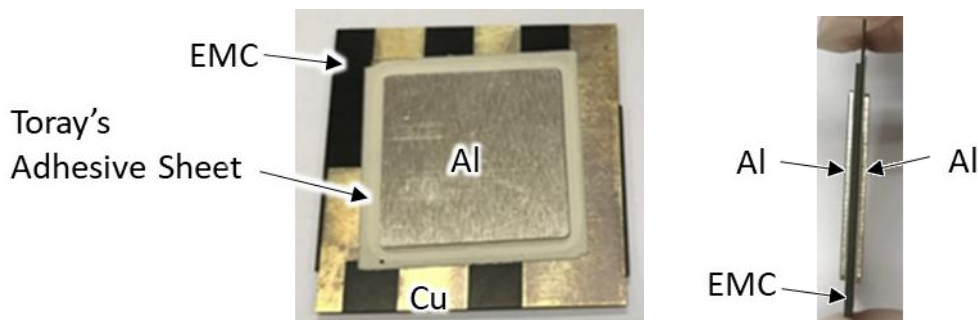
Toray offers electro-coating materials such as Semicofine™ non-photosensitive polyimide and Photoneece™ photosensitive polyimide which employ proprietary molecular design technology as well as FALDA™ adhesive film. Semiconductor, electronic component, and display manufacturers rely heavily on these products because of their high reliability.

Since 2016, Toray has participated in several international consortiums on IME’s advanced semiconductor packaging, deepening collaboration and achieving results through joint research.

Toray and IME previously collaborated to develop a robust SiC power semiconductor module that incorporates high-heat dissipation adhesive sheets from the FALDA™ lineup. General heat-dissipating adhesive materials using grease and solder have a large contact thermal resistance with the cooler, resulting in failure due to inadequate cooling of the

semiconductors. Toray and IME resolved these problems by applying Toray's material to create the first prototype of a new SiC power semiconductor module using a heat-dissipating adhesive sheet with a very low contact thermal resistance which is lower than conventional products. Durability tests (glossary note 2) at high temperatures confirmed that the module lasted for significantly large number of power cycles.

In this joint research, Toray and IME will continue to prototype and evaluate devices to improve the simplicity and reliability of processes to employ high-heat-dissipating adhesive sheets in the drive for commercialization.



<New SiC power semiconductor module (left: Top view, right: Side view)>

Yuichiro Iguchi, Corporate Vice President of Toray's Research Division, commented that, "We have long respected IME's prowess in SiC power semiconductor design and evaluation technology. We're delighted to collaborate with Singapore's government agencies on such public-private R&D projects. We look forward to accelerating efforts to overcome the challenges of applying advanced heat dissipation technology to enhance energy efficiency and help drive to sustainable economic growth."

Mr Terence Gan, Executive Director of A*STAR's Institute of Microelectronics, said, "We are pleased to team up with Toray to spur greater innovation in silicon carbide power semiconductors. Our mutual capabilities come together in a complementary fashion to enable the co-development of novel heat-dissipating solutions. Toray's R&D presence in Singapore will also help build a stronger R&D ecosystem in this part of the world."

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About Toray

Toray is a leading global company in innovative technologies and advanced materials. Since its foundation in 1926, the Company has contributed to society by creating new value and by addressing global challenges through high value-added products. These include fibers and textiles, resins and films, carbon fiber composite materials, electronic and information materials, pharmaceuticals and medical devices, and water treatment membranes and other environmental offerings. Toray operates in 29 countries and regions with about 49,000 employees worldwide. For more information, please visit our website at www.toray.com.

Toray Electronic & Information Materials website: <https://www.electronics.toray/en/>

Product Information Download:

<https://www.electronics.toray/en/download/ma/2208p1.html>

About the Institute of Microelectronics (IME)

Established in 1991, the Institute of Microelectronics (IME) is a research institute under Singapore's Agency for Science, Technology and Research (A*STAR). In IME, we focus on delivering high impact research and development for the global semiconductor industry. IME's role is to collaboratively develop and innovate next generation technologies to enable a dynamic semiconductor ecosystem. Together with our highly skilled talent pool, we develop strategic competencies and innovative technologies through state-of-the-art infrastructure. IME's core research areas are in Advanced Packaging, Sensors & Actuators, mmWave and Wide-Bandgap (SiC/GaN) technologies. We will continue to shape the semiconductor industry's roadmap for many years to come. For more information on IME, please visit www.a-star.edu.sg/ime.

About the Agency for Science, Technology and Research (A*STAR)

The Agency for Science, Technology and Research (A*STAR) is Singapore's lead public sector R&D agency. Through open innovation, we collaborate with our partners in both the public and private sectors to benefit the economy and society. As a Science and Technology Organisation, A*STAR bridges the gap between academia and industry. Our research creates economic growth and jobs for Singapore, and enhances lives by improving societal outcomes in healthcare, urban living, and sustainability. A*STAR plays a key role in nurturing scientific talent and leaders for the wider research community and industry. A*STAR's R&D activities span biomedical sciences to physical sciences and engineering, with research entities primarily located in Biopolis and Fusionopolis. For ongoing news, visit www.a-star.edu.sg.

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Glossary

1. Silicon carbide power semiconductors are advanced devices that could replace regular silicon counterparts in controlling and supplying electrical energy.
2. Durability tests estimate the reliability and service lives of power semiconductors connections subject to heat fatigue. Thermal stress from heating and cooling when turning module chip power on and off leads to a range of problems. These include peeling and cracks between materials with different linear expansion coefficients.