Introduction to Industry-Academia Collaborative R&D Programs (Super Cluster Program)

This program aims to form a globally competitive Super Cluster through wide-range collaboration in order to create innovation with high-impact in Japan. While exploiting the achievements of science and technology promotion measures in each area thus far, the government will initiate selection and concentration, finding the best match, based on social and market needs.

The “Core Cluster” will enhance potential of the new market development, strengthen the international competitiveness and revitalize R&D activities in the regional industrial sector under close cooperation with "Satellite Clusters" focusing on the seeds of technology and business models accumulated in the respective areas.

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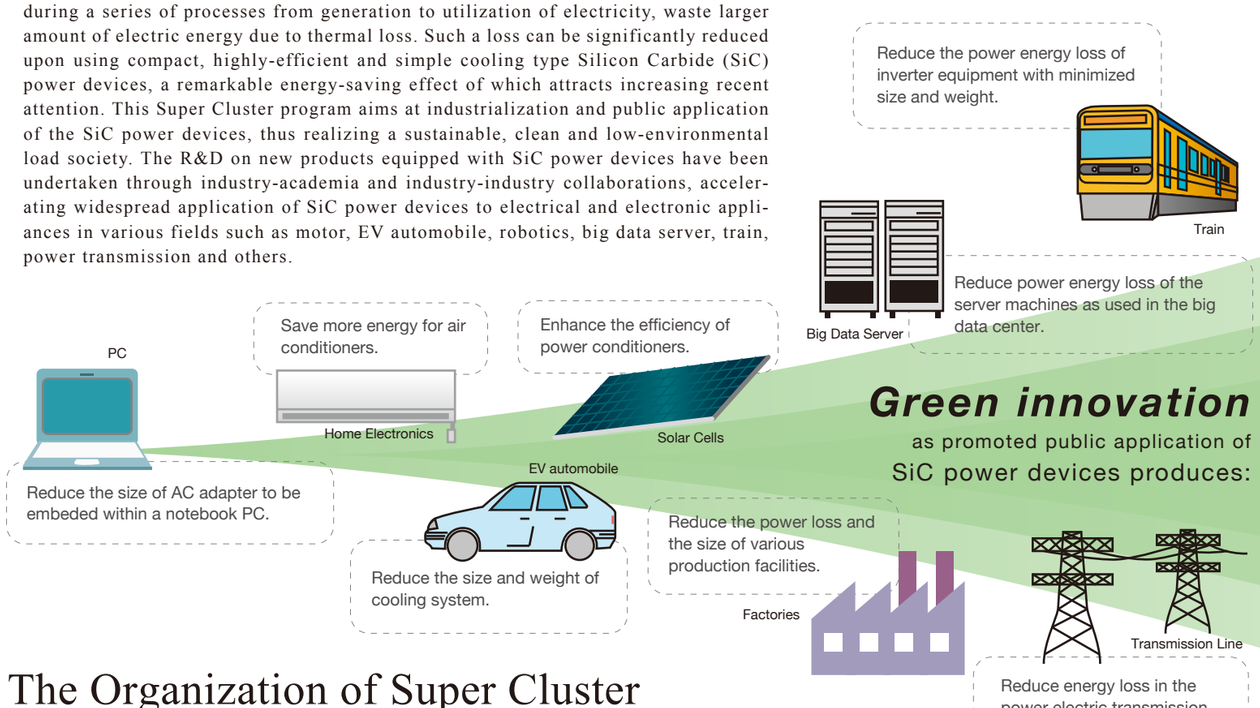
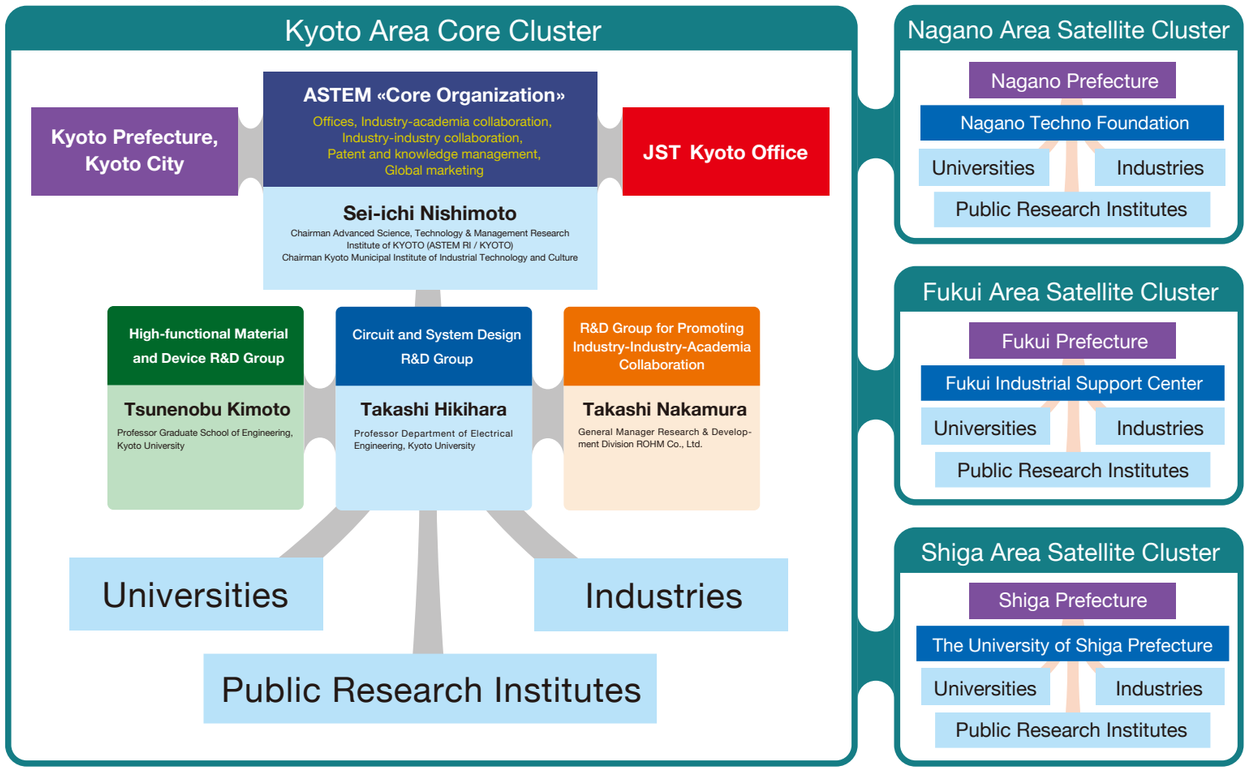
Kyoto Area Super Cluster Program

SiC Power Electronics Promotes "Construction of Highly-efficient Energy Utilization System for Realizing Clean and Low-environmental Load Society"

Silicon (Si) power devices, which are used in a variety of electric transformations during a series of processes from generation to utilization of electricity, waste larger amount of electric energy due to thermal loss. Such a loss can be significantly reduced upon using compact, highly-efficient and simple cooling type Silicon Carbide (SiC) power devices, a remarkable energy-saving effect of which attracts increasing recent attention. This Super Cluster program aims at industrialization and public application of the SiC power devices, thus realizing a sustainable, clean and low-environmental load society. The R&D on new products equipped with SiC power devices have been undertaken through industry-academia and industry-industry collaborations, accelerating widespread application of SiC power devices to electrical and electronic appliances in various fields such as motor, EV automobile, robotics, big data server, train, power transmission and others.



The Organization of Super Cluster for Promoting the Project



Organizations Participating in Kyoto Area Core Cluster

[Universities] Kyoto University; Kyoto Institute of Technology; Osaka University; Nara Institute of Science and Technology; Doshisha University; Ritsumeikan University; Aichi University of Technology
[Public Research Institutes] Kyoto Municipal Institute of Industrial Technology and Culture; Kyoto Prefectural Technology Center for Small and Medium Enterprises
[Industries] IKS Japan Co., Ltd.; ADTEC Plasma Technology Co., Ltd.; OMRON Corporation; KANEKA CORPORATION; KYOCERA Corporation; Kyoto Denkiki Co., Ltd.; KINKI ROENTGEN INDUSTRIAL CO., LTD.; KURITA Seisakusho Co., Ltd.; Samco Inc.; SHIMADZU CORPORATION; Sumitomo Electric Industries, Ltd.; TAKENAKA SEISAKUSHO CO., LTD.; NICHICON CORPORATION; NISSIN GIKEN Corporation; NIDEC CORPORATION; Pulsed Power Japan laboratory ltd.; Fukushima SiC Applied Engineering Inc.; HORIBA, Ltd.; Murata Manufacturing Co., Ltd.; ROHM Co., Ltd.; WAKO GIKEN CO., LTD. and others as participate later.

Promoting Public Application of SiC Power Devices to Realize a Clean and Low-environmental Load Society

The Kyoto Area Core Cluster is composed of 3 R&D groups through industry-academia and industry-industry-academia collaboration, thereby promoting application of the SiC power devices to a wide variety of commodities. Achieving this objective, the 3 R&D groups collaborate closely with one another as in a gear system involving a rational cycle of providing technology seeds, evaluating technology, and requesting new technological needs.

The goal of Kyoto Area Core Cluster is "Construction of Highly-efficient Energy Utilization System for Realizing Clean and Low-environmental Load Society" through close collaboration with 3 Satellite Clusters in Nagano, Fukui and Shiga areas, which produce component technologies according to demands by the Core Cluster.

R&D Group for Promoting Industry-Industry-Academia Collaboration

- Promote public application of SiC power devices through industry-academia and industry-industry collaborations
- Support small and medium enterprises to develop and commercialize products with SiC power devices

Device manufacturing industry — *Equipment manufacturing industry* — *System manufacturing industry*

Needs / Seeds

High-functional Material and Device R&D Group

- Develop next-generation SiC power devices with higher performances
- Development of technology combining both semiconductor light-emitting element and SiC
- Development of technology combining both upgraded solar cell and storage battery and SiC power electronics

High-functional Material and Device R&D Group

Needs / Seeds

Circuit and System Design R&D Group

Circuit and System Design R&D Group

- Develop generalized technology of circuit design to drive SiC power devices
- Develop compact and light-weight equipment leading to a large energy conservation effect
- Development of SiC mounting module and implementation technology
- Develop fundamental technology applicable to next-generation power packet transmission

Integration with Component Technologies

Nagano Area Satellite Cluster — *Fukui Area Satellite Cluster* — *Shiga Area Satellite Cluster*

Full-scale spread of SiC power device and evaluation test used for public application

Nagano Area Satellite Cluster

- Development of heat resistant insulating material
- Development of magnetic device systems for power electronics
- Development of magnetoplated coil device

Fukui Area Satellite Cluster

- Development of societal technology using SiC power device with nano plating
- Development of battery material suitable for storage battery unit using SiC power device
- Development of bench marking technology for power conversion device using SiC

Shiga Area Satellite Cluster

- Development of high-efficiency solar power generation system and film technology
- Development of optimum charge control system from unstable electric power to Li-ion battery
- Development of electric power converters for a PV system