

Realization of a low carbon society through game changing technologies

Research and Development of Magnetic Core Materials for 100 MHz Switching Power Supplies

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Summary :

- **Problem** ; The current hundred kHz switching power supplies have difficulty of their down-sizing and light-weight because of **a no choice of magnetic core for high frequency beyond 1MHz.**
- **Solution** ; Novel Fe-based composite magnetic materials and WBG power devices will solve the problem (Frequency; 100MHz, Power density; 100 W/cm³, and 5% Efficiency-increase by 2050).
- **Effect** ; 15 billion kWh/year (9.35 million ton Co₂ /year) reduction only in ICT and electronics sector in Japan by 5% efficiency improvement



Power supply systems;
Strong needs for higher efficiency and compact/light-weight
Current hundred kHz switching power supply
Power density; <5W/cm³, Efficiency; 80~90%
It should be able to down-size the power supply by introducing SiC/GaN and by increasing frequency beyond 1MHz.
(But no choice of high frequency magnetic core except Ni-Zn ferrite)

This study
Novel 10~100MHz low-loss magnetic core and WBG power device

Exploratory R&D (FY2017~2021)	Regular R&D (FY2022~2026)
(1) R&D of Fe-based composite magnetic core and reactor/transformer	R&D of power module
(2) R&D of fundamental technologies of power module (current CISPR regulation - 95% efficiency - 10W/cm ³ power density)	Efficiency ≥ 95% Power density ≥ 20W/cm ³ Next CISPR regulation

An example of power module

In 2050, Freq. 100MHz, Power density 100W/cm³, Efficiency ≥ 95%