

In a Nutshell

The FOR²ENSICS project aims to develop disruptive UHV SiC materials and devices, enabling more compact, efficient, and reliable power electronics with reduced losses and carbon emissions.

Unlike current industry roadmaps, FOR²ENSICS targets bipolar SiC devices above 10kV, opening new possibilities for grid applications. The project will also develop a next-generation DC solid-state transformer (SST) to demonstrate the advantages of these UHV SiC devices in real-world power conversion.

By advancing SiC materials, fabrication, and device design, FOR²ENSICS paves the way for industrialization and supports the future needs of high-voltage DC power systems.

Project objectives

Pillar 1

1. Develop 15 kV SiC IGBT Module for MVDC applications
2. Develop a wafer splitting technology that can reuse SiC wafers up to 10 times

Pillar 2

1. Define an efficient test methodology related to UHV semiconductor devices
2. Demonstrate the reliability of SiC IGBT devices and passive components used in the demonstrator

Pillar 3

1. Develop a DC/DC converter (SST) for interface between MVDC and LVDC based on a Dual Active Bridge
2. Identify at least 3 use cases for early adoption of the High Voltage SiC technology and DC SST

Who we are



CSIC IMB-CNM
www.imb-cnm.csic.es

Spain



Coherent
www.coherent.com

Sweeden



University of Cambridge
www.cam.ac.uk

United Kingdom



Hitachi Energy
www.hitachienergy.com

Switzerland



Deep Concept
www.deepconcept.fr

France



University of Bremen
www.uni-bremen.de

Germany



Ecole polytechnique fédérale de Lausanne
www.epfl.ch

Switzerland



SuperGrid Institute
www.supergrid-institute.com

France

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FOR²ENSICS

Ultra high voltage SiC Solutions for MVDC Solid State Transformers

Expected results

- Improved process for Ultra High Voltage SiC bipolar devices manufacturing with high yield
- Splitting process for reuse of SiC Wafer up to 10 times
- Development and manufacturing of 15 kV SiC IGBTs
- Development and manufacturing of a 15 kV power module based on the 15 kV IGBT
- Increased reliability of 15 kV SiC IGBTs and 3.3 kV SiC MOSFETs
- Development and manufacturing of 10 kV – 10 kHz – 250 kW Medium Frequency transformer
- Development and manufacturing of 10 kV – 250 kW Inverter based on series connected 3.3 kV SiC MOSFETs
- Development and manufacturing of a 1.5 kV to 10 kV 250 kW DC/DC Solid State Transformer for MVDC applications

Project Identity

Project Title:
Future Oriented Renewable
and Reliable Energy SiC Solutions

Grant Agreement N°: 101075672

Start date: 1st January 2023

Duration: 48 months

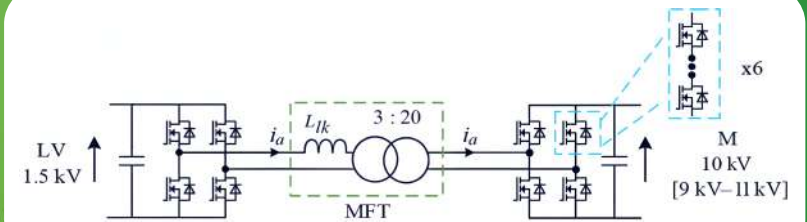
Budget: 8,121,120.00 €

Find out more

Website: www.for2ensics.imb-cnm.csic.es

Solid state transformer

Bidirectional MV DC/DC transformer



Technologies

15 kV SiC IGBT

10 kV – 250 kW Series connected SiC MOSFET inverter

10 kV – 10 kHz – 250 kW Medium frequency transformer

10 kV to 1.5 kV DC/DC SST



15 kV SiC IGBT module



Use cases

PV

EV charging

H2 electrolysis

Datacenter

Industrial

