U.S. DEPARTMENT of ENERGY

THE OHIO STATE UNIVERSITY

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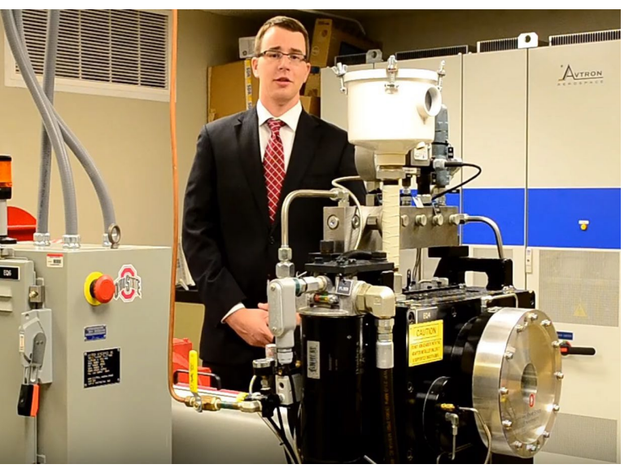
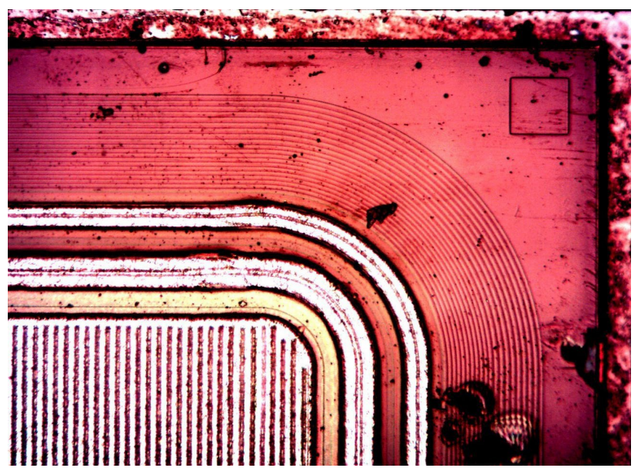




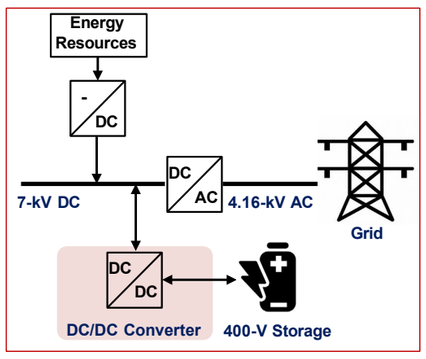
Medium-voltage Power Electronics for Grid-tied Energy Storage Applications

Dr. Pengyu Fu, Yizhou Cong, Alex Rizzoni, Dr. Jin Wang, and Dr. Anant Agarwal

PROJECT DESCRIPTION

► **Project objectives:**

- **Design and evaluate a medium voltage wide bandgap (WBG) semiconductor-based power converter for grid-tied energy storage applications to improve energy storage system performance.**

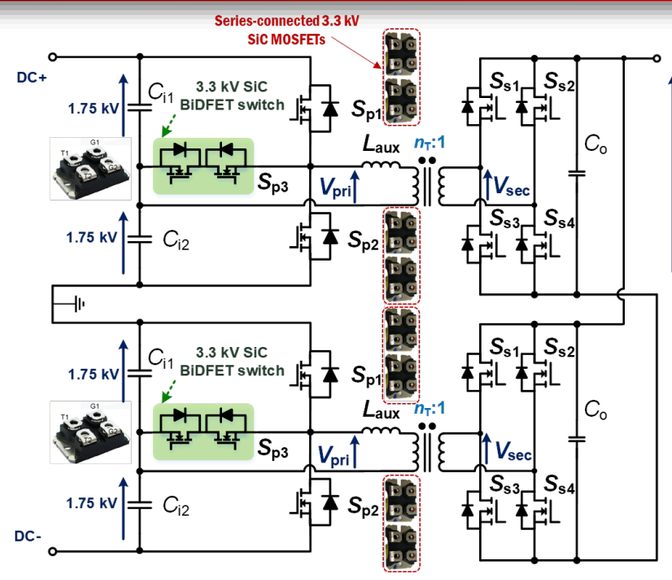


MVDC based energy harvesting system with storage

► **Main research tasks:**

- **Evaluation of medium voltage SiC devices for performance.**
- **Development of suitable gate drive circuits for medium voltage SiC devices.**
- **Design and testing of a medium voltage SiC device-based bidirectional isolated DC/DC converter.**

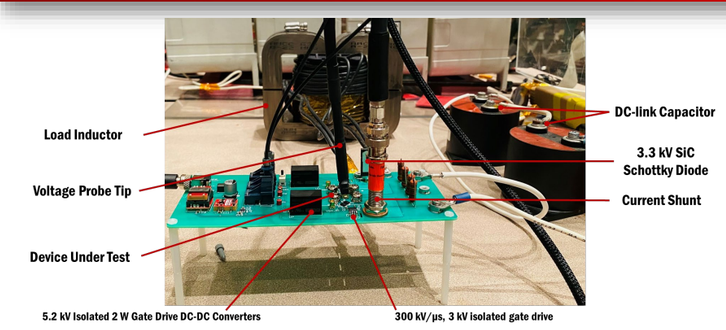
PROPOSED SOLUTION



► **Benefits of the proposed solution:**

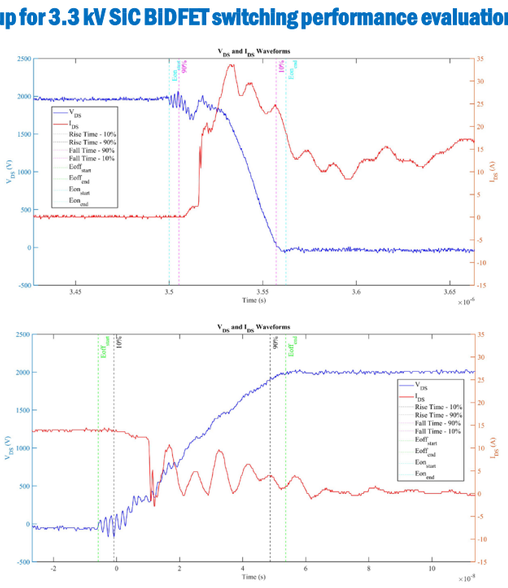
- **Modular and scalable high-gain DC/DC converters with reduced current ripples into the energy storage system.**
- **Compact medium voltage stages with monolithic SiC BiDFETs.**
- **Direct series connection of 3.3 kV SiC MOSFETs for reduced power loss and device cost.**

3.3 kV SiC Bidirectional MOSFET Evaluation

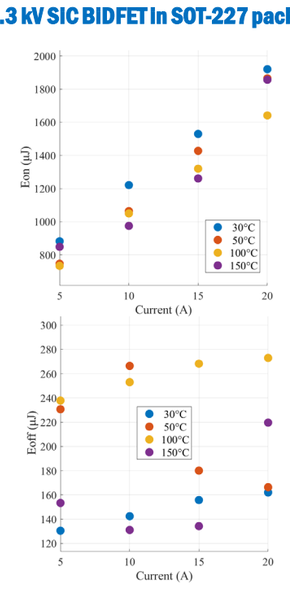


Setup for 3.3 kV SiC BiDFET switching performance evaluation

3.3 kV SiC BiDFET in SOT-227 package

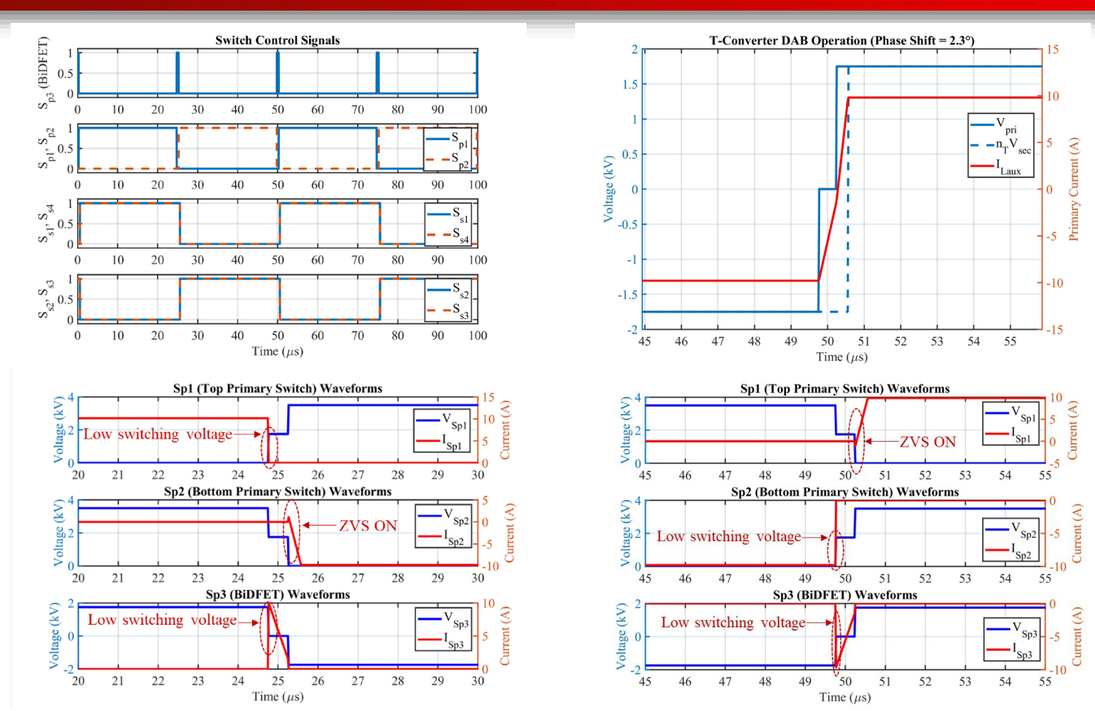


2 kV/15 A turn-on and turn-off transients



Switching on and off energy loss at 2 kV

OPERATION OF THE T-DAB CONVERTER



► **Features of the operation:**

- **An additional degree of control via the zero-state duration.**
- **Reduced maximum dv/dt on transformer windings due to the introduction of zero state.**
- **Reduced switching stress on medium-voltage switching devices.**

Funding support from Office of Electricity Energy Storage Program and SiC BiDFETs from NoMIS Power are gratefully acknowledged.

August 2025