New energy generation and energy transmission technologies

The Institute for Superconducting and Electronic Materials (ISEM) is a world-class cooperative research team working on the fields of energy, superconductivity and electronic material science and technology.

Led by Professor Shi Xue Dou, an internationally renowned expert in the fields of innovative materials, ISEM has been instrumental in advancing these technologies in Australia.

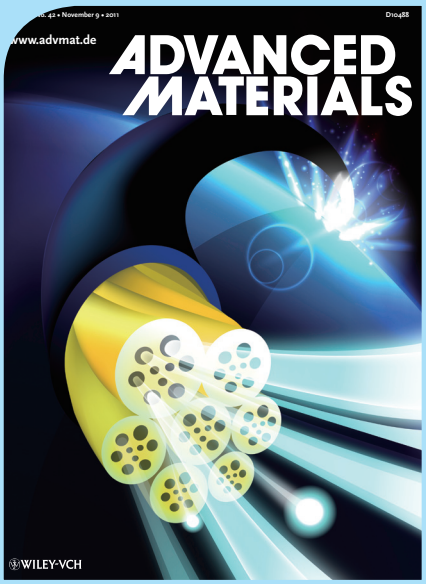
ISEM has a team of more than 100 researchers and postgraduate students with a track record of research breakthroughs that are helping to redefine the applications of materials science.

Superconducting Wires

ISEM's research program investigating superconducting materials is focused on producing new materials to be used in energy generation and transmission.

Superconducting wires have higher maximum current densities and zero power dissipation allowing them to be smaller and more efficient than traditional copper wire – meaning increased energy efficiency and lower carbon emissions.

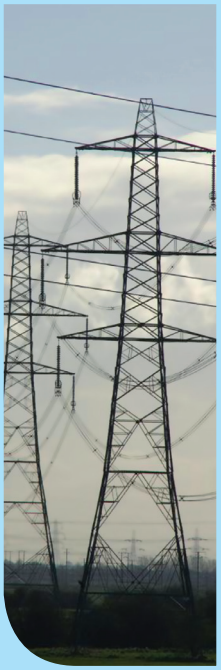
ISEM's groundbreaking, patented technology has already been licensed to manufacture superconducting wire for electricity transmission.



New Technologies, New Applications

The superior efficiency and the fact that superconducting wires have zero power dissipation mean that this technology is set to change the way that energy can be generated and stored. Superconducting wires can be used in a range of equipment including:

- Fault current limiters which will help electricity continue to flow in the event of a fault in the distribution network;
- The next generation of magnetic resonance imaging (MRI) machines;
- Electricity transmission networks;
- Wind turbines; and
- Dye sensitised solar cells.



Contact us for more information

For more information on ISEM's energy generation and transmission research program and commercial opportunities contact Professor Shi Xue Dou on +61 2 4221 5730 or via email at shi@uow.edu.au or visit ISEM's website at www.isem.uow.edu.au

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Projects to improve energy generation and transmission underway at ISEM include:

Project	Magnesium diboride (MgB2) superconducting fault current limiter (FCL)
Aims	To demonstrate MgB2 superconductor application in real-life fault current limiters in power grid.
Description	Electrical power grids need protection against faults, such as short circuits and lightning strikes. Circuit breakers and high-impedance transformers have been traditionally used for this purpose. A new generation of fault-current limiters (FCL) employing superconducting technology can solve this problem without requiring expensive upgrades of existing grids or using cryogenic liquids to maintain superconductivity. A prototype of such superconducting FCLs is being developed at ISEM. The project merges the expertise on superconductivity at ISEM, FCL prototype design at the Faculty of Engineering and industrial production and design of FCL's at Zenergy Power Pty Ltd (Australia). The FCL using MgB2 superconducting coil consumes very low energy from the grid. Such an FCL can be retrofitted into existing grids, to provide protection under fault conditions without negative effects under normal working conditions.

Project	Novel wind turbine using magnesium diboride (MgB2) superconducting magnet for wind energy generation
Aims	To demonstrate MgB2 superconductor application in wind energy generation.
Description	Wind energy generation is an important source of renewable energy. Wind turbines generate electricity with static magnetic field generators which require magnetic materials with high energy product, low conductivity, and high Curie temperature. Although rare-earth-based magnets satisfy the design criteria, rare earth prices have increased by up to 750 per cent in the last year. A significant advance in magnesium diboride superconductor using patented nano-doping developed by ISEM has paved the way for an ideal alternative for wind generators winding coil magnet which is cheaper and lighter with higher static field. For example, the gear box based generator for 10 MW wind turbine weighs for 500 tonnes while MgB2 based generator for the same power rate will be reduced to only 70 tonnes – a weight reduction of 86 per cent while still meeting the electrical, mechanical, thermal and reliability requirements. MgB2 coils, the cooling system and cryostat will be designed and produced according to the requirements of generator for wind-mills. In collaboration with its industry partner Hyper Tech Research Inc, ISEM team has the expertise to design and test the coils on the basis of the previous and current research work on FCL and MRI.