

SHIKAZONO LAB.

Efficient Energy Conversion



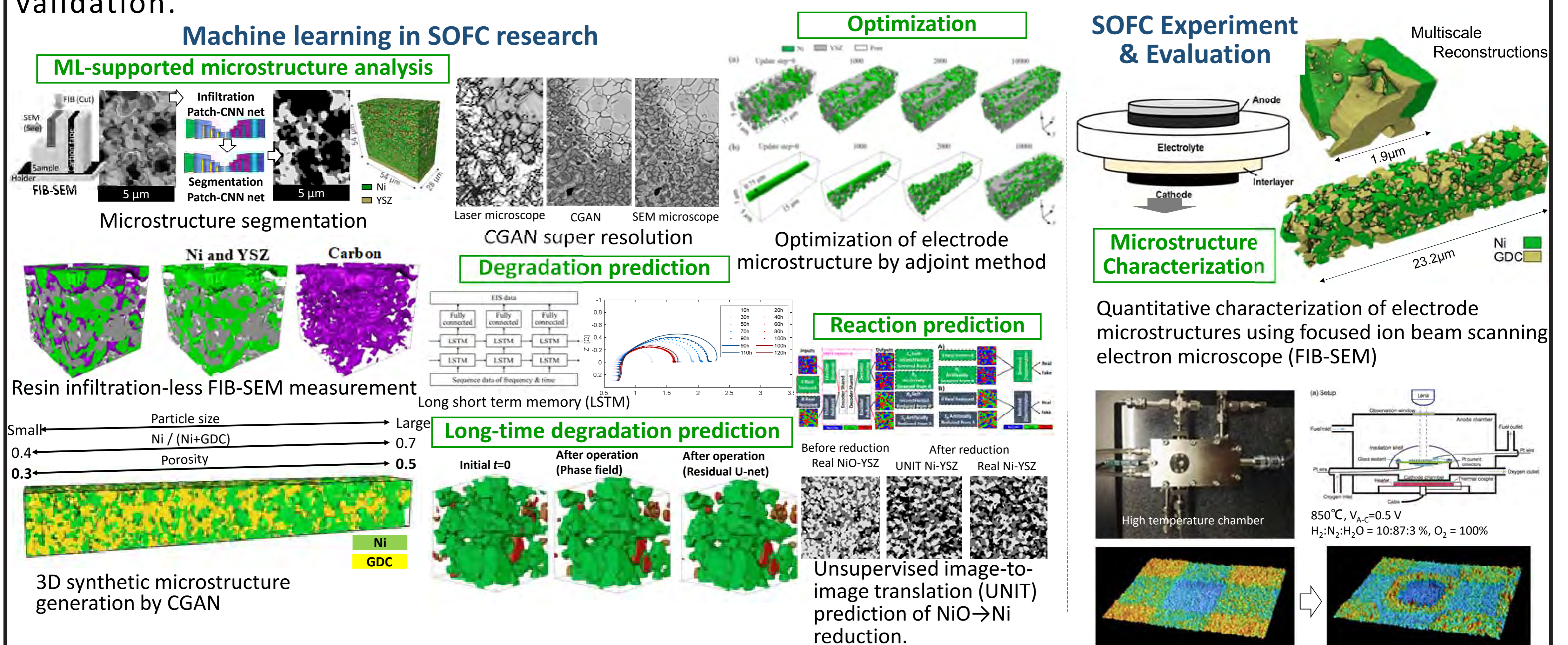
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 Research Center for Sustainable Material Energy Integration
 Energy System Integration Social Cooperation Program

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<http://www.feslab.iis.u-tokyo.ac.jp/index-e.html>

Electrode Microstructures of Solid Oxide Fuel Cell (SOFC) & Electrolysis Cell (SOEC)

Electrode microstructures strongly affects the performance and reliability of solid oxide fuel cells (SOFCs) and electrolysis cells (SOECs). Machine learning, e.g. CNN, CGAN, UNIT, LSTM, PINN etc., as well as numerical simulations such as lattice Boltzmann, phase field, kinetic Monte Carlo and discrete element methods are developed to optimize the characteristics of the electrodes from initial powder to long time operation. Three dimensional microstructures reconstruction by FIB-SEM and operando observations play inevitable role for understanding the phenomena and model validation.



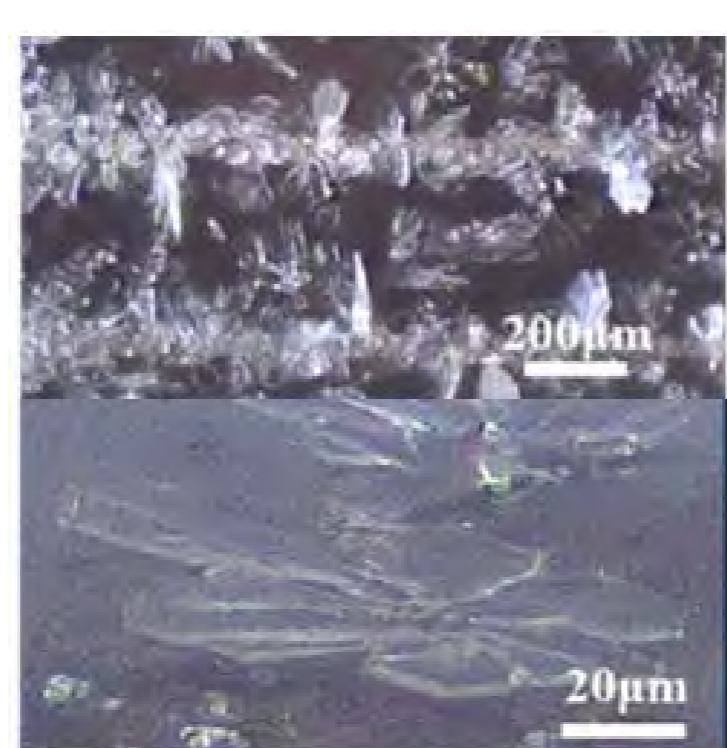
R&D on Heat Pumps & Heat Engines

Efficient utilization of thermal energy is becoming even more important in the energy demand side. In order to reduce exergy loss, heat cycles which operate at small temperature difference, and component technologies such as efficient heat exchangers and gas-liquid separators are developed under collaboration with industry partners.

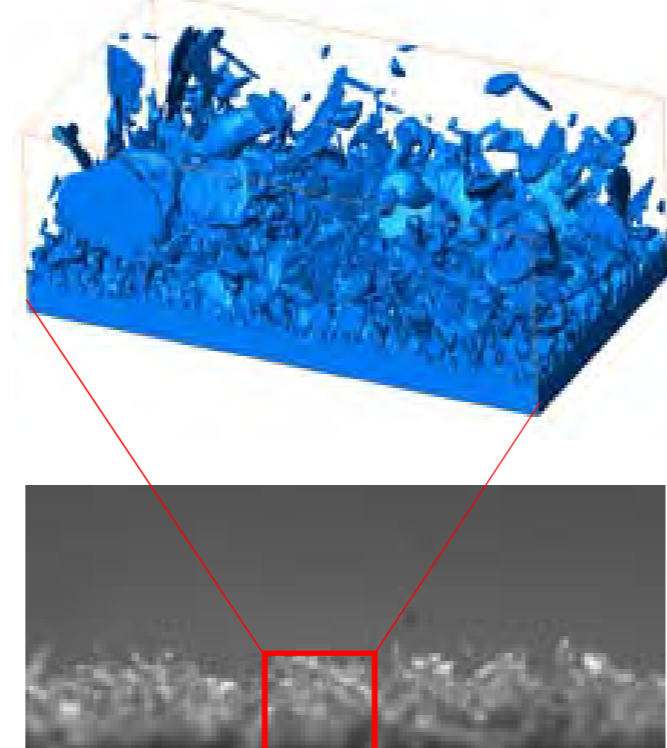
- Novel steam/refrigerant cycles (2 phase expansion/compression, Lorenz cycle)
- 3D measurement of frost microstructure
- Heat exchangers and gas-liquid separators, etc.



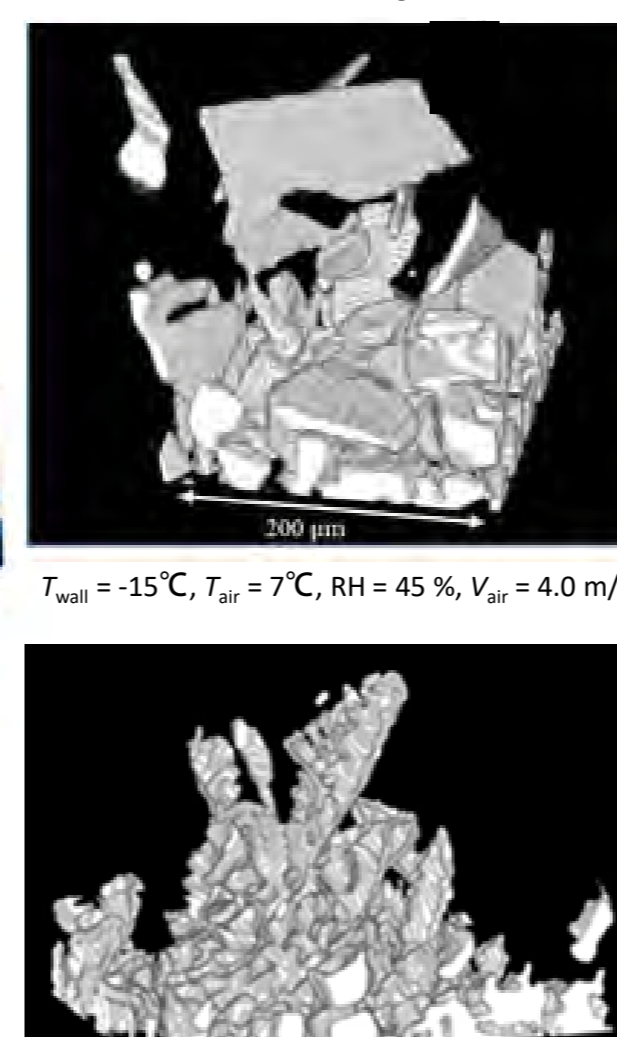
Vibration-free two phase expander



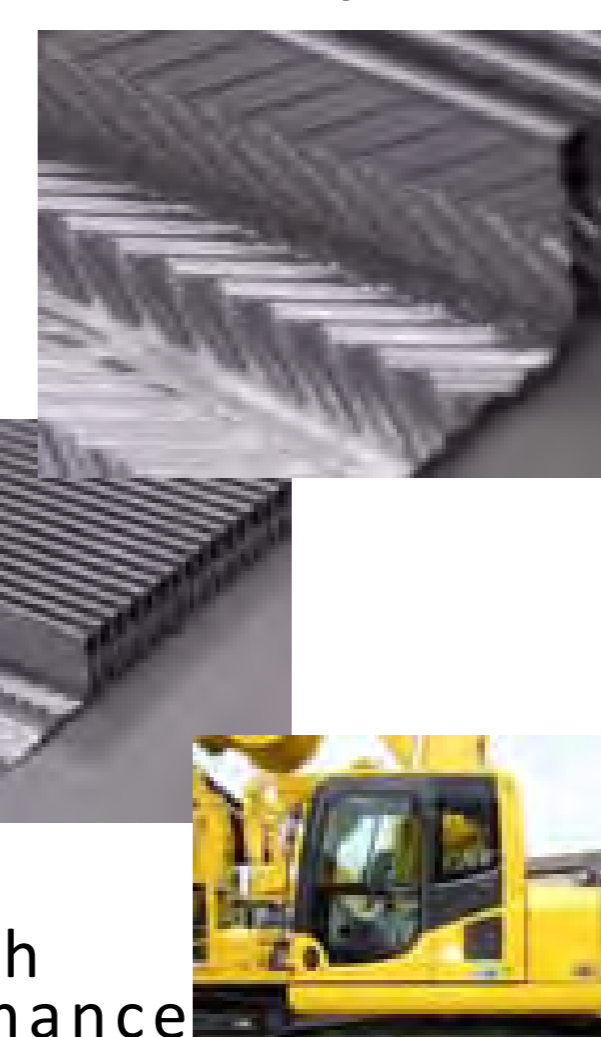
Planar frost growing on AgI pattern



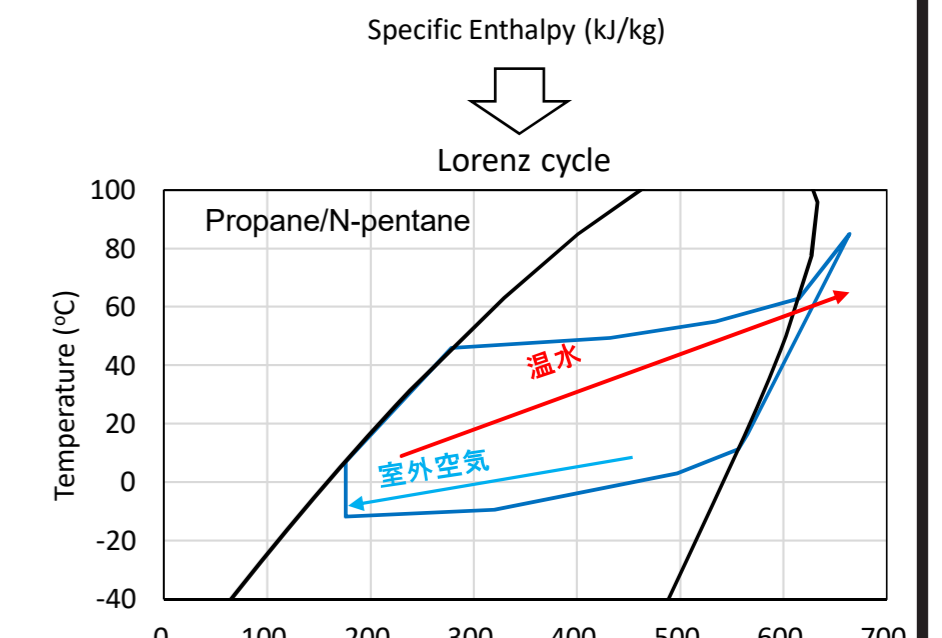
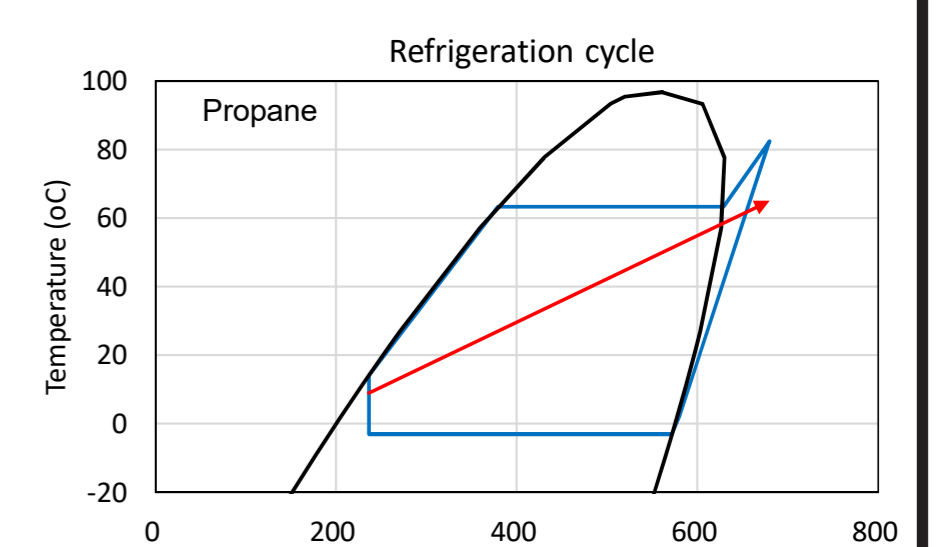
Reconstruction of frost 3D microstructure



High performance anti-scale V-fins



High performance anti-scale V-fins



Large temperature glide Lorenz heat pump