

KOMATSU LAB.

Electrochemical Energy Conversion

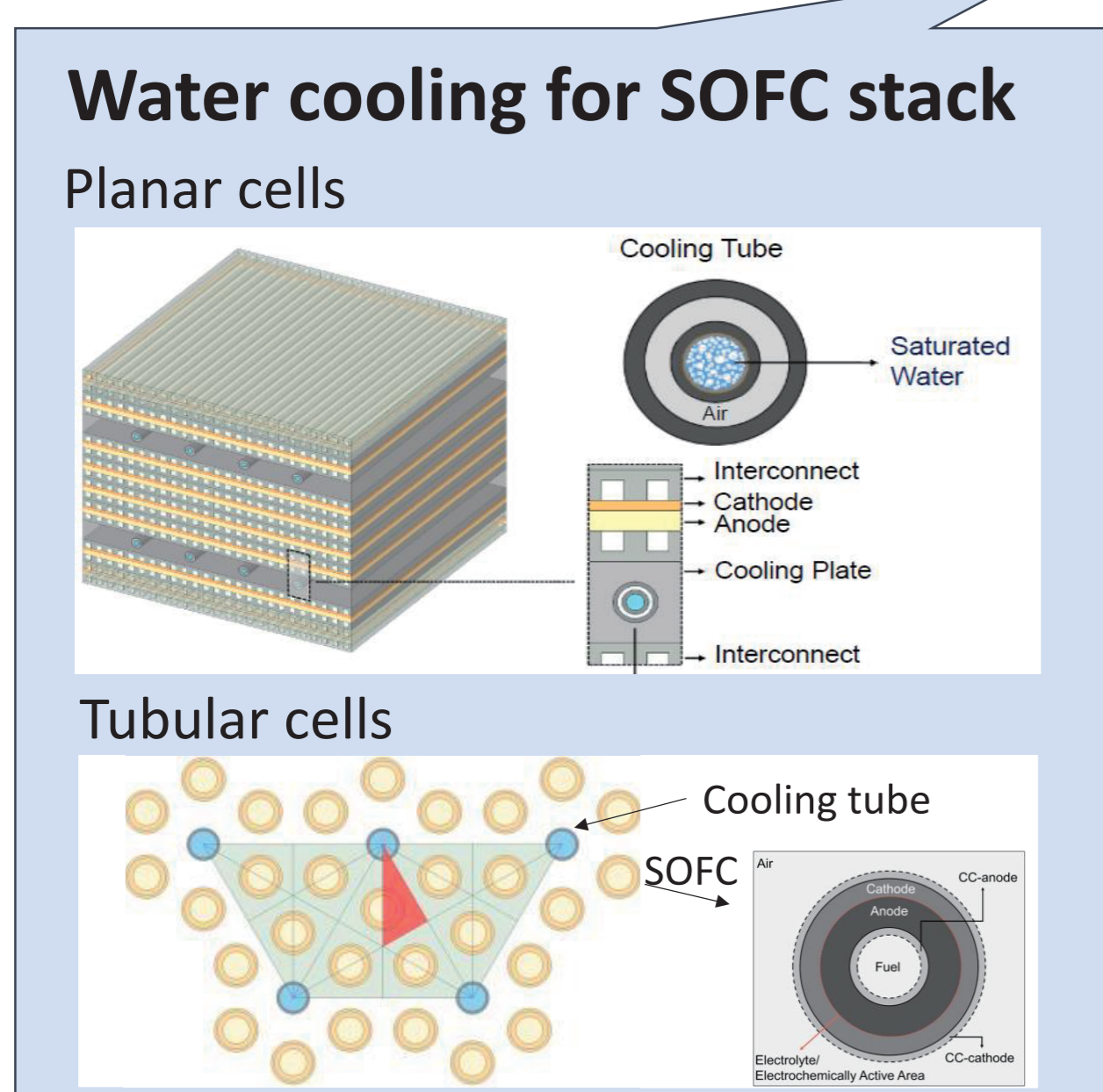
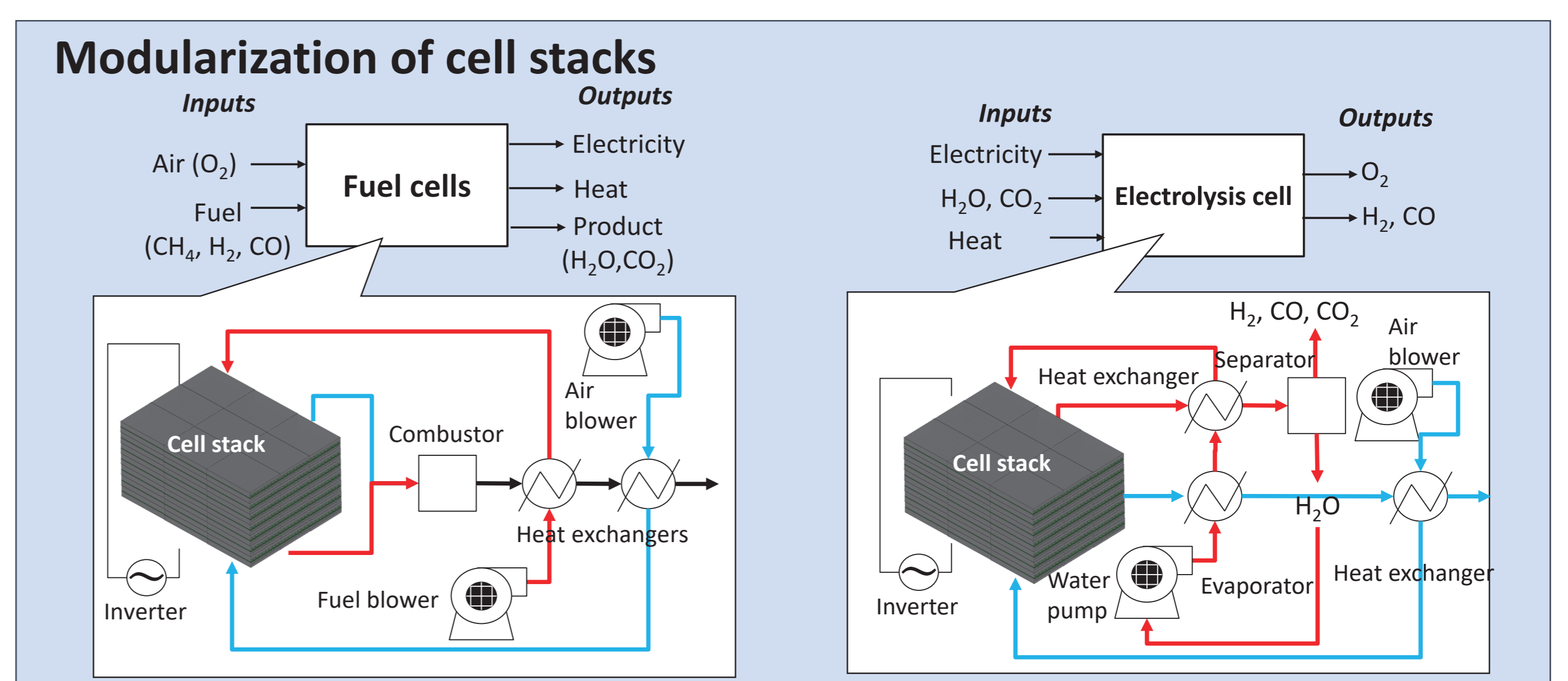
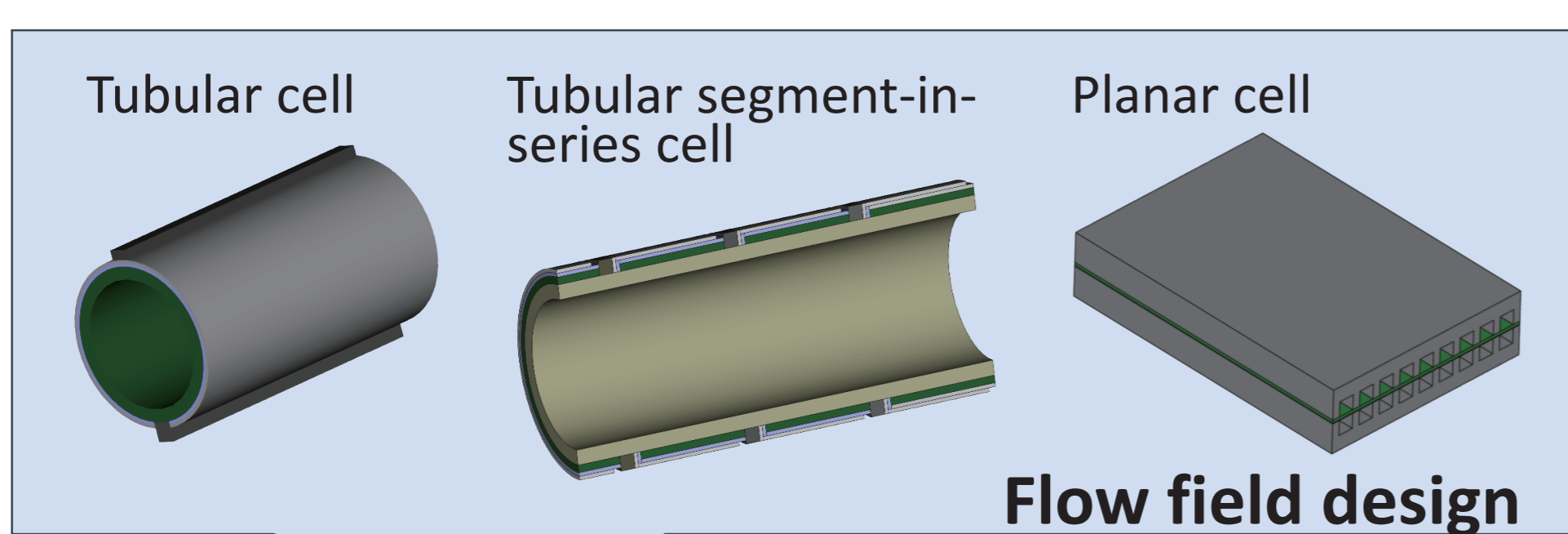
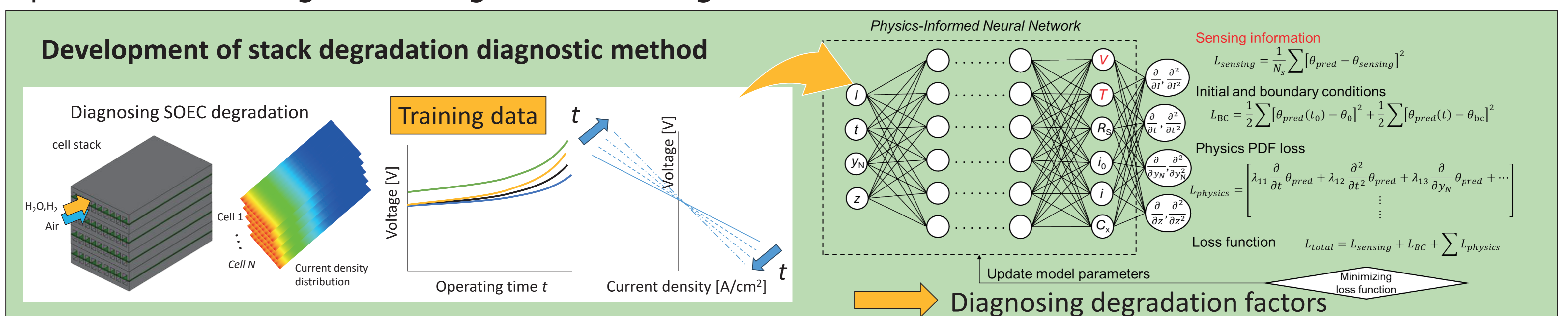


Department of Mechanical and Biofunctional Systems

Electrochemical Cell Design Engineering

Towards Energy Conversion Technologies Using Solid Oxide Cells

Solid Oxide Cells (SOCs) are energy conversion devices that contribute to power generation and fuel production through electrochemical reactions, operating as either Solid Oxide Fuel Cells (SOFCs) or Solid Oxide Electrolysis Cells (SOECs). Since the ionic conductivity of the oxide electrolyte determines the operating temperature (600–1000°C), thermal management is a key aspect of system design. Because SOFC and SOEC operations differ in their operating requirements and internal reaction pathways, their system-level thermal management strategies also differ. Contributing factors of performance degradation during high-temperature operation also differ depending on the operating mode. Our research focuses on predicting degradation behavior and identifying degradation factors using simulation tools such as machine learning and thermo-fluid analysis. Furthermore, it aims to optimize designs from cell and cell-stack structures to module- and system-level configurations, as well as to develop operational strategies for degradation mitigation.



Modularization

Cell stacking

Single cell design

System Integration

