

Research Objective

Estimate the remaining useful lifetime of an IGBT Power Module during operation: Power semiconductor device (IGBT, MOSFET, Diode) reliability requirements have increased over the recent years. However, it is needed to improve the safety, the longevity and the life-cycle cost of IGBT power modules and programming an efficient maintenance by estimating the end of life of a device. Hence, This research focuses on the analysis, modeling and exploitation of the on-state voltage in wire-bonded power modules in order to estimate the remaining useful lifetime (RUL) of IGBT power module.

Expected Contributions

The enabling method is RUL estimation which implies:

- Predict components' degradation evolution of the power module
- Estimate the state of health.
- Estimate the end of life of device.
- Propose a maintenance strategy.

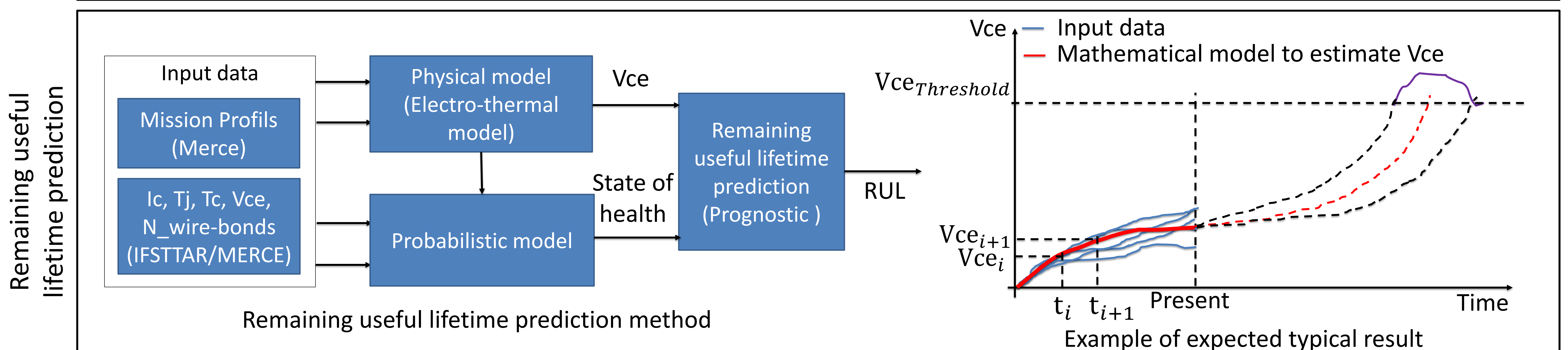
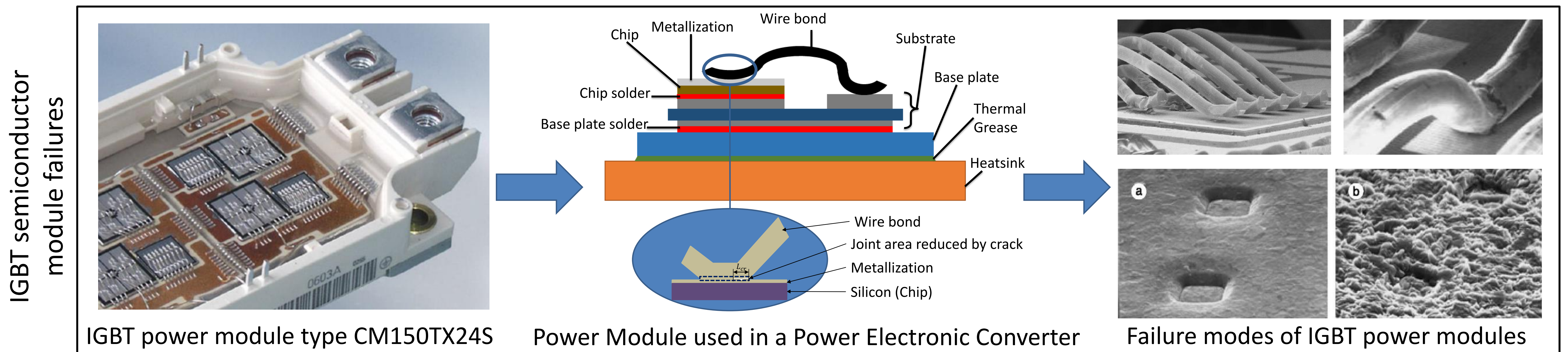
Research Details

State of Research

- Study of degradation mechanism and failure modes of IGBT power modules.
- Analysis the on-state voltage of the wire-bond as its evolution reveals information concerning the strength and the state of health of the device
- General bibliographic on the Prognostic and Health Management techniques that can be applied to complex systems under non-linear and non-stationary working conditions.
- Study of uncertainty related tasks in prognostics

Next Steps

- Develop a physical model to estimate the degradation of IGBT power module.
- Propose an adapted probabilistic model to predict the degradation evolution in the time.
- The output of the method is the on-state voltage and the remaining useful lifetime of the module.
- The probabilistic model allows estimating of uncertainties. Then, RUL and estimation uncertainties interval will therefore be defined.



Acknowledgments and References

Mitsubishi Electric Centre Europe in partnership with IFSTTAR and FEMTO-ST.