forsta varme

UNDERSTANDING HEAT

Cell-to-pack thermal conductivity characterization

Thermal Management Expo USA – Ohio, 2026

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forsta varme
UNDERSTANDING HEAT

What we do

- Full-service thermophysical testing lab
- Advanced thermal conductivity hardware
- Thermal management material co-development

Our customers

- Raw material producers
- TMM formulators
- Reliability simulations
- Sub-system designers
- OEM system integrators

Ansys STARTUP PROGRAM

NVIDIA Inception Program

aws activate

Thermal property measurement of Pack components

Part 1: Gap fillers



Part 2: Batteries



Thermal management material gap fillers are more complicated than the highest thermal conductivity

Critical thermal pathway

Thermal management material gap fillers are more complicated than the highest thermal conductivity

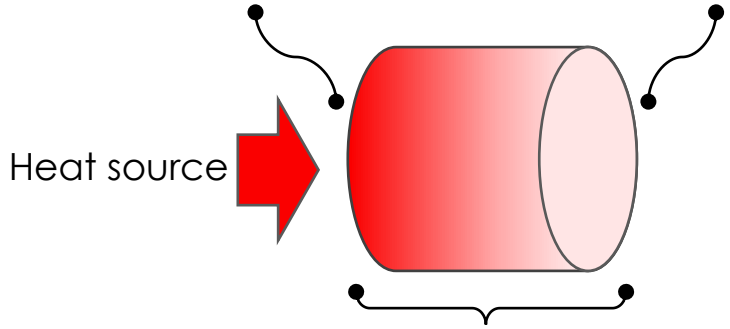
Critical thermal pathway

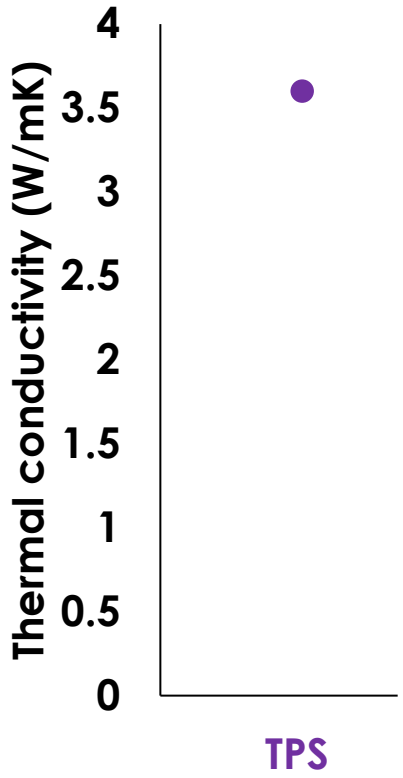
Other crucial properties:

- Thickness
- Compressibility
- Softness
- Electrical insulation
- Binder composition
- Pump out and delamination
- Application method

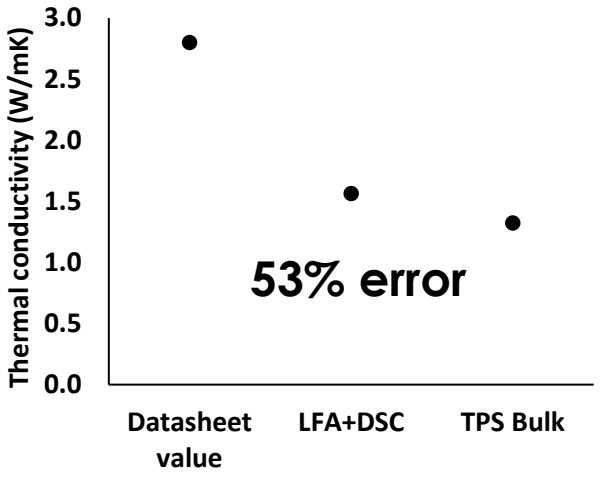
Battery pack gap filler thermal conductivity **datasheet values are almost always wrong**

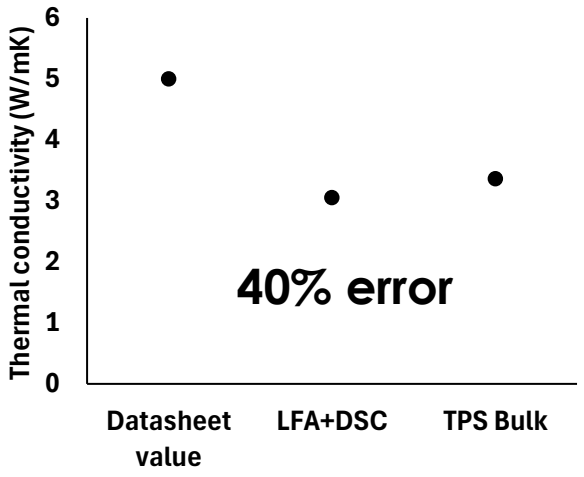
Transient plane source (TPS)
measures transient **applied heat**

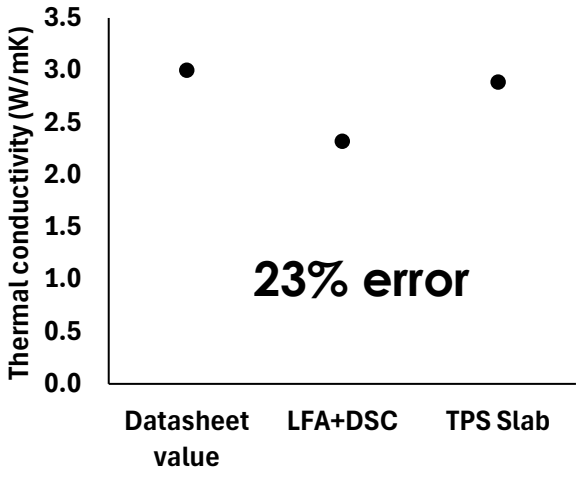


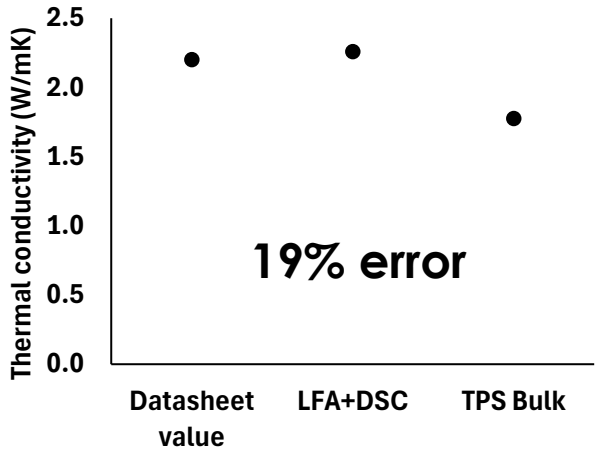


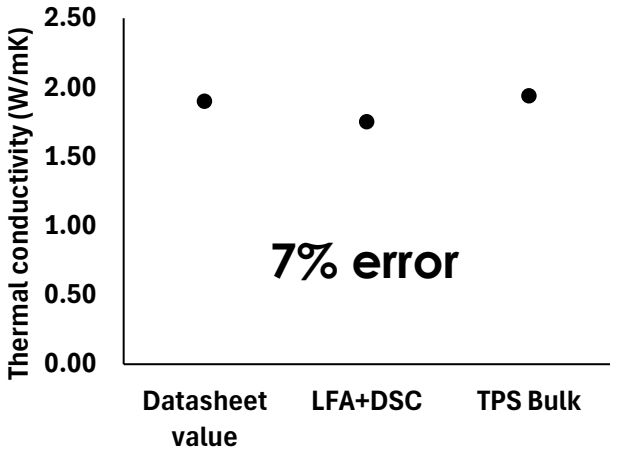
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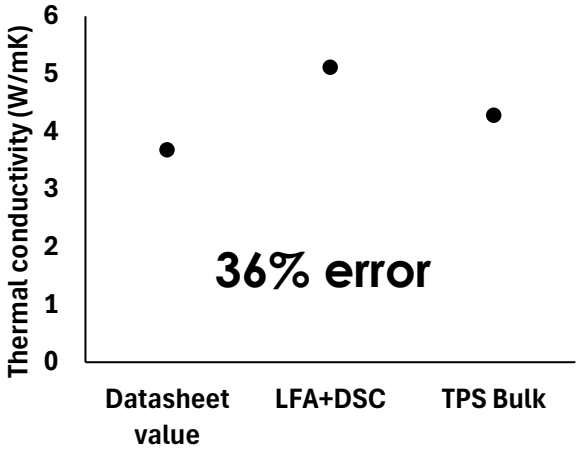




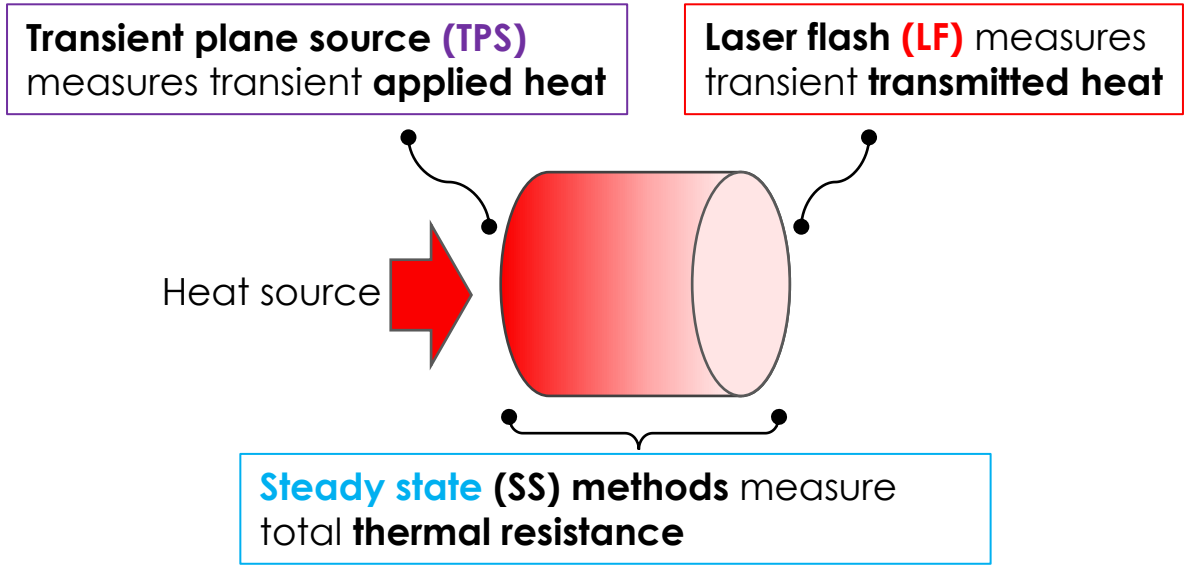


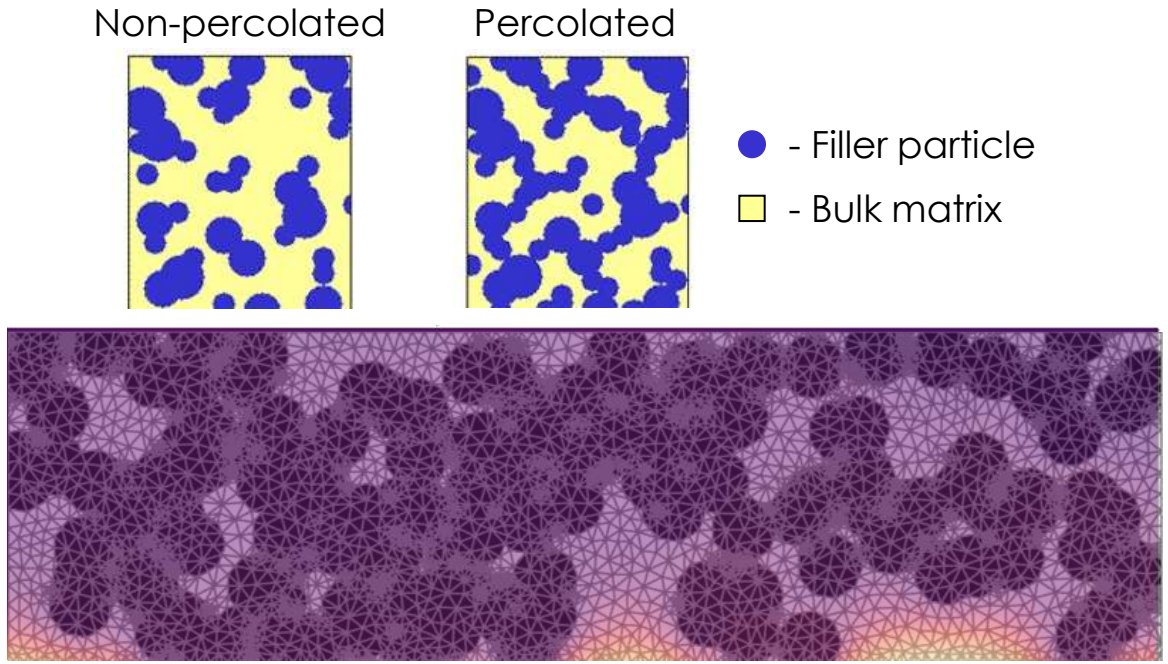






Thermal heterogeneity arises in **highly filled** or structured **composites**





- Internal material structure is **neglected by** standard measurement method **models**
- Measurement values are **highly repeatable**, but differ by method

- Thermal heterogeneity arises even if particles are well distributed, from **conduction pathways**

Two complementary methods. One mission.

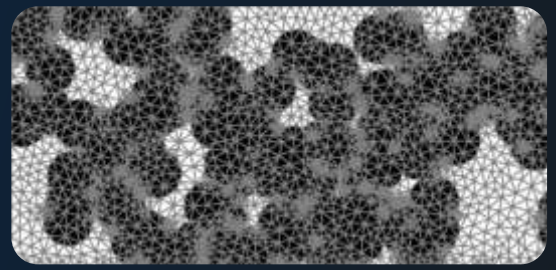
Transforming transient heat flow into actionable material insight

Reveal®

Thermal heterogeneity detection

Plug-and-play machine learning models and dedicated hardware for qualification of composite data

Output



Detected thermal heterogeneity

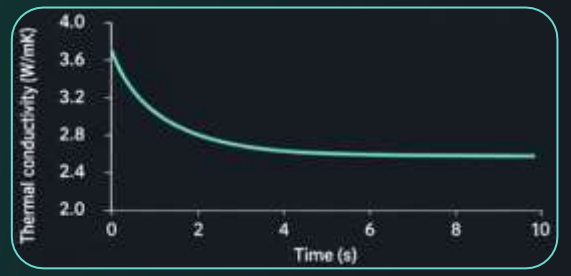
Spatial map of non-ideal transient heat flow within the composite

Resolve®

Dynamic thermal conductivity

Next generation method for design and interpretation of advanced thermal conductivity signatures

Output



Time-resolved conductivity signature

Dynamic thermal conductivity as a function of time

Enabling superior material qualification and rational design
for advanced thermal management composites

Part 2: Battery cells

Part 1: Gap fillers



Part 2: Batteries



Measuring battery cell components is **difficult and still wrong**









Forsta Varme is supported by federal and private research funding agencies to develop battery solutions

- Degradation due to small, local, thermal gradients
- Prediction of cell temperatures
- Temperature based charging protocols requiring high accuracy internal data



Government of Canada

Development of Apparatus, Dataset, and Machine Learning Approach to Thermal Heterogeneity Quantification, Material Design and Thermal Simulation Alignment

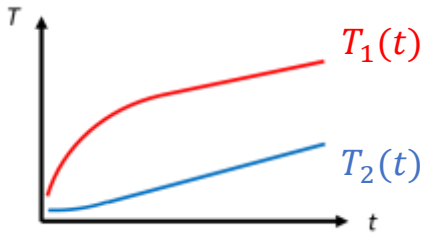
NBIF

Next-generation battery measurement and modeling for enhanced pack longevity through reduced thermal degradation

Experiment-in-the-loop measurement and simulation provide the most precise and accurate battery cell characterization possible

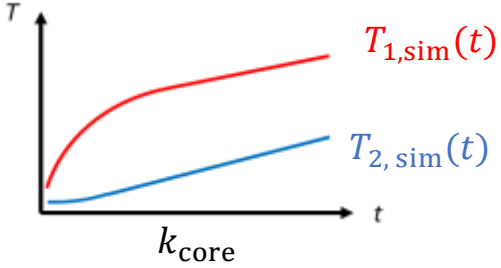
Measured Data



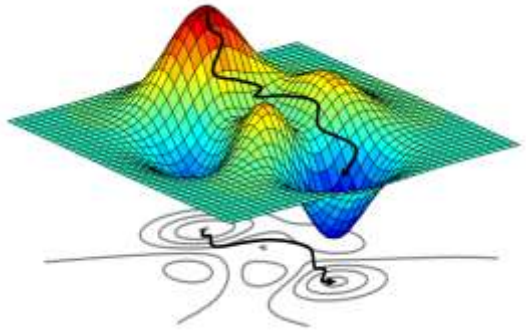


FEM Simulation





Error minimization function



Minimum reached?

Finish Optimization, return $\boldsymbol{k_{\mathrm{core}}}$

Key outputs

- Core (jellyroll) thermal conductivity without shell
- Specific heat capacity

Experiment-in-the-loop measurement and simulation provide the most precise and accurate battery cell characterization

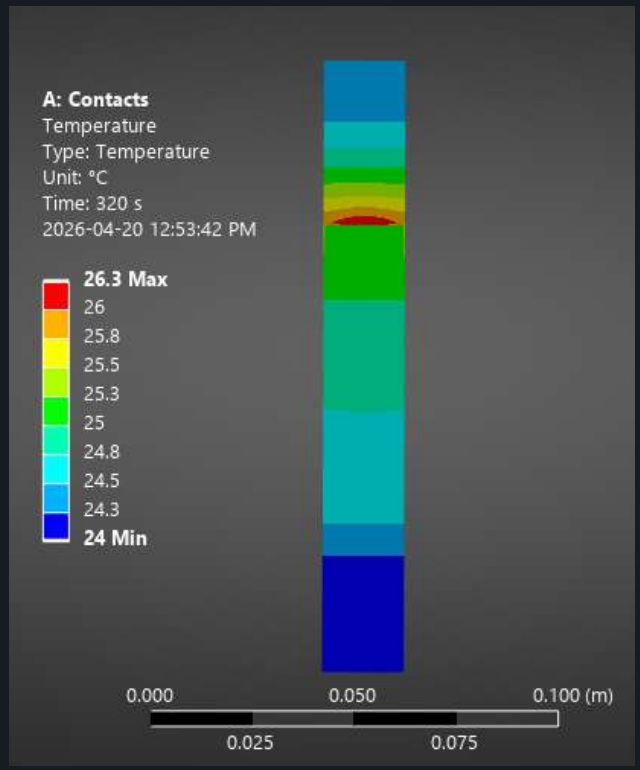
Batteries

Dynamic thermal conductivity

Measurement data inverse parameter finding from iterative simulation produces exact internal cell effective thermal conductivity values accounting for shell, state of charge, and contact resistance

Output

- Jelly roll thermal conductivity
- Heat capacity, heat loss coefficient, labeled 3D model



Enabling superior material qualification of battery cells
for advanced thermal management

Key Takeaways

- Measurement data relies of the key assumptions of fit models

Reveal: Thermal heterogeneity detection

- Qualify thermal conductivity measurement methods and values

Resolve: Dynamic thermal conductivity

- Understand and rationally design thermal behavior of composite materials