



# Two-Session-Clustering Workshop

03.03.2021 | SESSION 2: Powerfilms for infrared radiative heating

Presenter:

Daniel HABENBACHER



**HONDA**



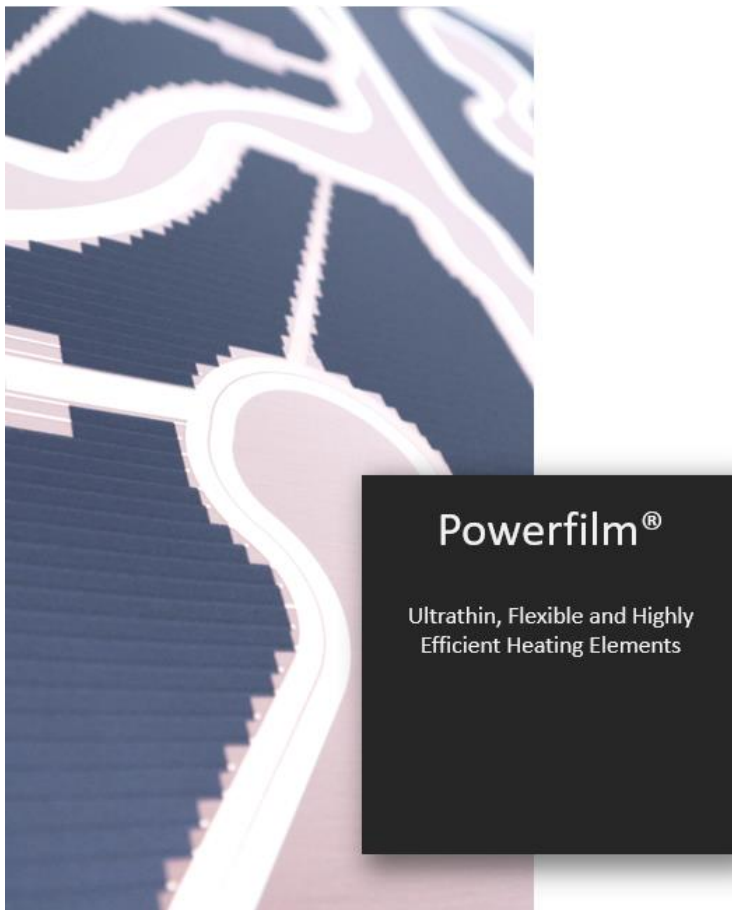
**Fraunhofer**  
IFAM



**SeatTec**  
Sitztechnik GmbH



## Portfolio ATT POWERFILM



- Additive or subtractive lay-up
- AC/DC up to 800v validated
- Maximum power up to 50 kw/m<sup>2</sup>
- Lightweight
- Thin and flexible
- Typical temperature range up to 120° C
- Maximum possible temperature 250° C
- With or without PTC effect
- Carbon or transparent version
- Fully customizable:
  - Size and shape (2D/3D)
  - Materials selected specifically for each application
  - Interface to heated product (application, heat transfer)
  - Thermal and electrical insulation

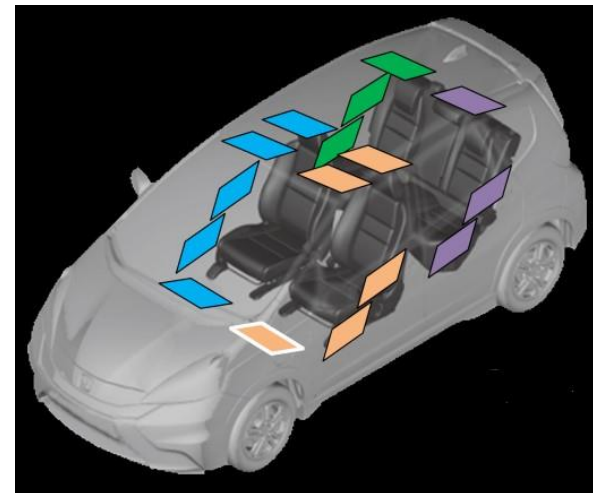


# Tasks of ATT in the QUIET Project

## RADIATIVE HEATING ELEMENTS

Development of an energy saving interior heating concept

- Tasks of ATT:
  - Definition of suitable interior parts that can be heated
  - Design of heating elements and control unit
  - Production of heating elements and control unit
  - Integration and optimization of ECU parameters
- Interior parts with attached heating foils
  - 2 heating elements at each door (8)
  - sunvisors (2)
  - Footwell driver (1)
  - Footwell passenger (1)
  - Roof (4, above each passenger)



## Heating foil (sunvisor) LAYER STRUCTURE

- Protective coating
  - Screen printed protective ink
- Active layer
  - Screen printed carbon ink
- Electrodes
  - Etched copper electrodes
- Substrate
  - Polyimide
- Sensor
  - Etched copper meander
- Adhesive tape

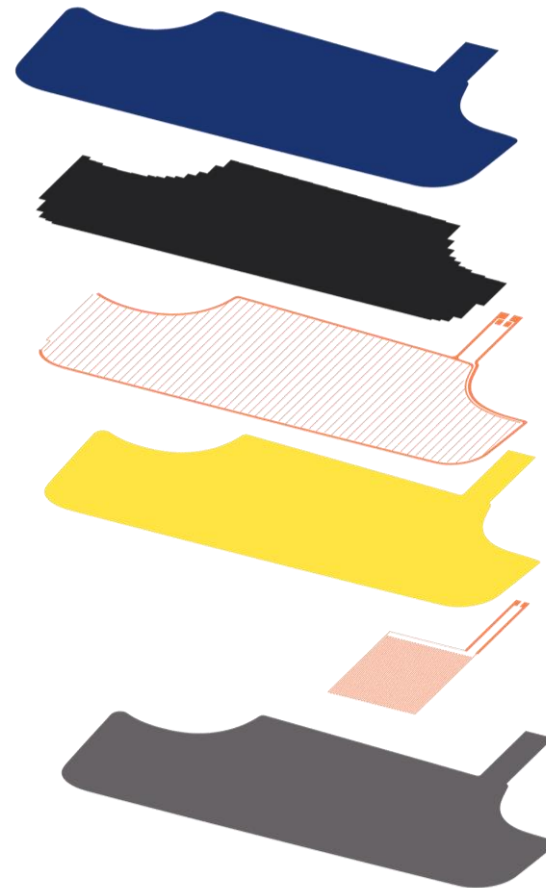


Figure 4: Layer structure of a heating foil

# Heating foil (sunvisor) RESULTS

- Heating power density
  - Simulation
  - Verification of electrode and carbondesign
  
- Produced heating foil
  - Applied on a 3D GFRP (glass-fibre reinforced plastic)
  - Homogenous heat distribution over the whole area

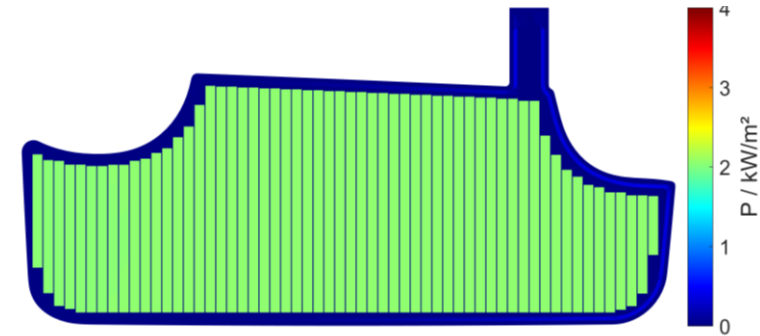


Figure 5: Heating power density

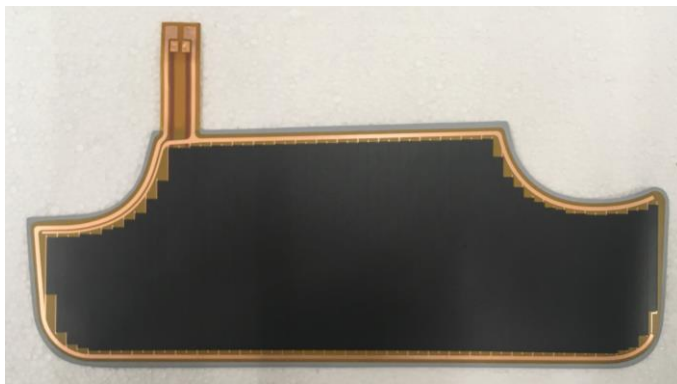


Figure 6: Produced heating foil

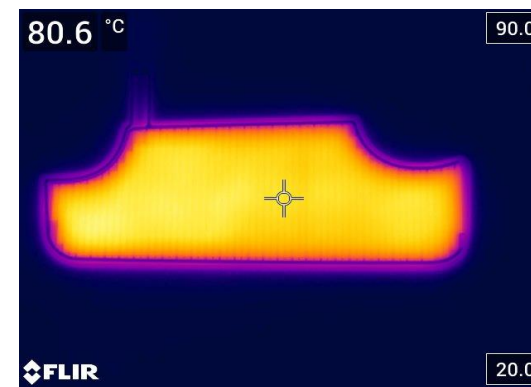


Figure 7: Infrared picture at 80° C of the applied heating foil

# ECU CONSTRUCTION

- 3 independent DC/DC- converter modules with each 750 W power
  - 400 V → 48 V
- The CU is divided into three sections. Each section contains two or three power boards
- All boards of the CU are securely bolted onto copper busbars, which also include the functionality of the power delivery system

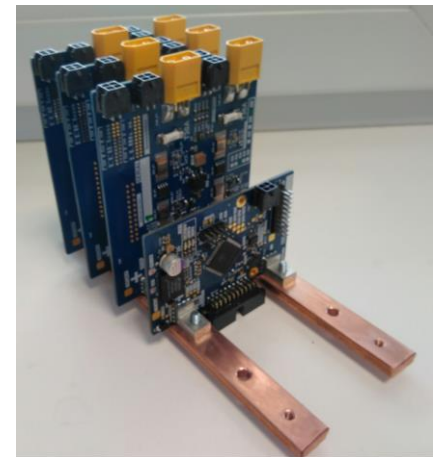


Figure 8: Power boards, bolted onto copper busbars

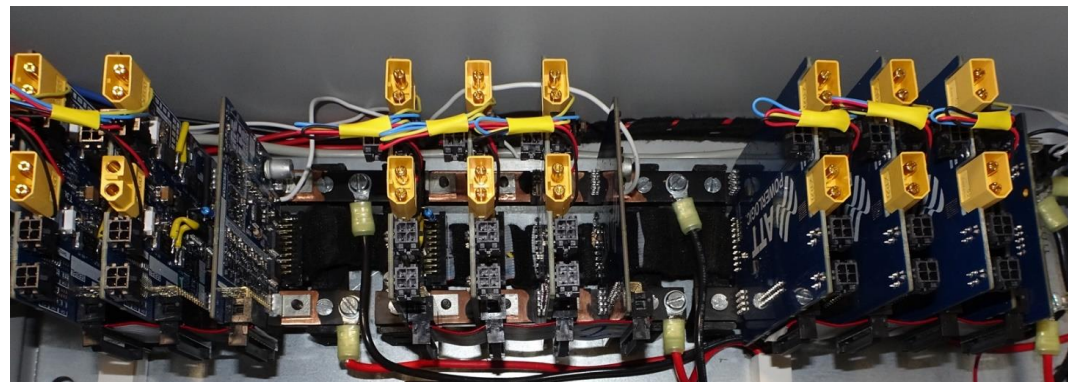


Figure 9: left: DC/DC converter modules; right: three sections with power boards



## Development of the ECU RESULTS

The ECU 's firmware complies with the following functionalities:

- Control of the heating foils
- Current draw and voltage level
- CAN communication
- Read-out of calibration values

GUI (Graphical User Interface):

- Switch on/off each heating foil independently
- Individually set value for control variable (power per area [ $W / m^2$ ])
- Monitor measurements over time



Bezeichnung	Spannung	Strom	Leistung	Intemperatur	Solltemperatur	Steuergesamt	Vorgabe	PWM-Wert	Widerstandswert	Ein/Aus
Roof Back, right	14,440V	0,90A	13,0W	59,7°C	60,0°C	60,0°C	75	16,00Ohm	Engeschaltet	
Roof Back, left	26,970V	1,24A	33,5W	58,4°C	60,0°C	60,0°C	75	22,00Ohm	Engeschaltet	
Door Back 2, right	41,160V	2,10A	86,5W	59,4°C	60,0°C	60,0°C	75	20,00Ohm	Engeschaltet	
Door Back 2, left	0,046V	0,00A	0,0W	-99,0°C	60,0°C	60,0°C	75	INFOhm	Engeschaltet	
Door Front 2, right	48,190V	1,89A	91,3W	58,6°C	60,0°C	60,0°C	75	25,00Ohm	Engeschaltet	
Door Front 2, left	48,040V	1,46A	70,0W	57,6°C	60,0°C	60,0°C	75	33,00Ohm	Engeschaltet	
Sunvisor, Passenger	47,580V	1,17A	55,5W	57,4°C	60,0°C	60,0°C	75	41,00Ohm	Engeschaltet	
Sunvisor, Driver	47,550V	1,11A	52,8W	57,0°C	60,0°C	60,0°C	75	43,00Ohm	Engeschaltet	
Footwell, Passenger	47,620V	1,64A	78,2W	55,0°C	60,0°C	60,0°C	75	29,00Ohm	Engeschaltet	
Footwell, Driver	47,800V	1,20A	57,6W	56,6°C	60,0°C	60,0°C	75	40,00Ohm	Engeschaltet	
Door Front 1, right	47,110V	3,75A	176,7W	60,3°C	60,0°C	60,0°C	75	13,00Ohm	Engeschaltet	
Door Front 1, left	47,560V	4,00A	190,2W	60,3°C	60,0°C	60,0°C	75	12,00Ohm	Engeschaltet	
Roof Front, Driver	48,030V	2,90A	139,1W	57,3°C	60,0°C	60,0°C	75	17,00Ohm	Engeschaltet	
Roof Front, Passenger	48,050V	3,73A	179,5W	58,7°C	60,0°C	60,0°C	75	13,00Ohm	Engeschaltet	
Door Back 1, right	47,970V	4,47A	214,2W	60,3°C	60,0°C	60,0°C	75	11,00Ohm	Engeschaltet	
Door Back 1, left	48,000V	1,10A	52,9W	56,4°C	60,0°C	60,0°C	75	44,00Ohm	Engeschaltet	
			1490,9W							

Figure 10: GUI

Daniel HABENBACHER

ATT advanced thermal technologies GmbH

Phone: +43 664 88 16 56 38

Email: [daniel.habenbacher@thermaltech.at](mailto:daniel.habenbacher@thermaltech.at)

Website: [www.thermaltech.at](http://www.thermaltech.at)

