

Computational Thermomechanical Modelling of a Compact High-performance Electric Compressor

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Research pitch and its relevance (1/4)

- Electric vehicles are the way of the future
- Developing an electric version of the compressor manufactured by *SuperCool/Unicla*
- The **challenge** is to make the electric drive as small as possible which creates problems for heat removal



Fig1: Electric vehicle

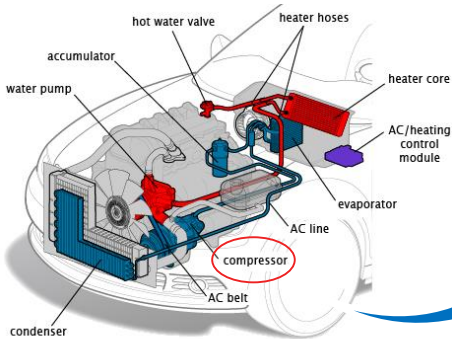


Fig2: Vehicle air conditioning

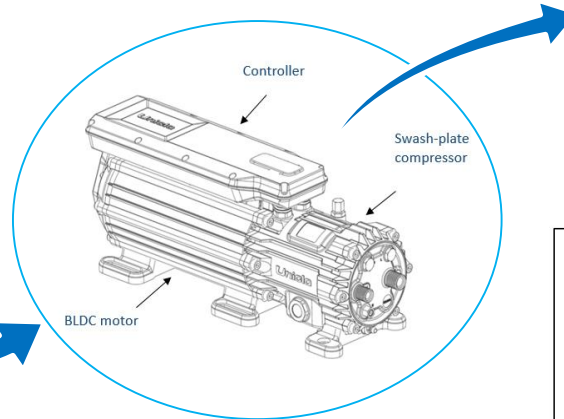


Fig3: Swash-plate electric compressor for mobile refrigeration currently **under development** at *SuperCool Asia Pacific*

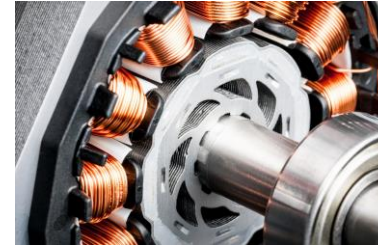


Fig4: Brushless DC motor

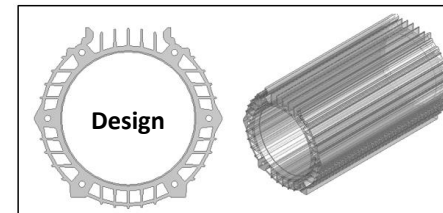


Fig5: Cooling jacket for BLDC motor

PhD

Research pitch and its relevance (2/4)

- The cooling performance of the motor is being investigated through CFD modelling
- Suitable fin designs have been proposed for **extrusion moulding** of the cooling jacket

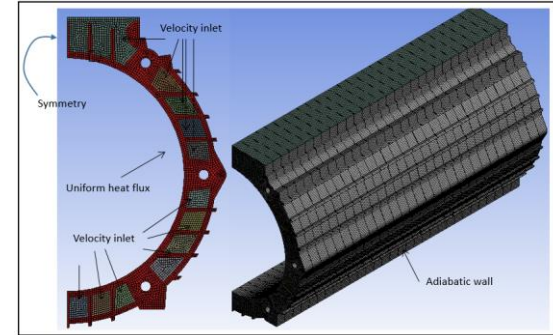


Fig6: computational Mesh for 3D simulation

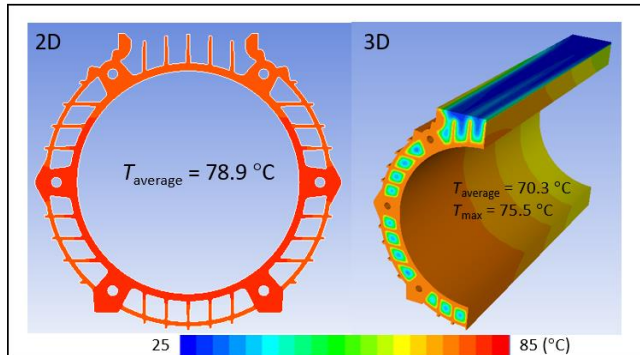


Fig7: Calculated temperature distributions for 2D and 3D calculations (400W)

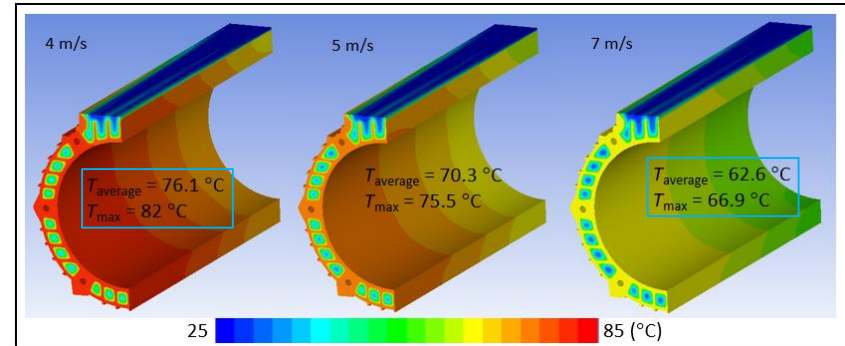


Fig8: Calculated temperature distributions for different flow velocities (400 W, 25 °C environment)

Research pitch and its relevance (3/4)

- 3D Calculations were done with ANSYS FLUENT including heat transfer from the IC in the controller

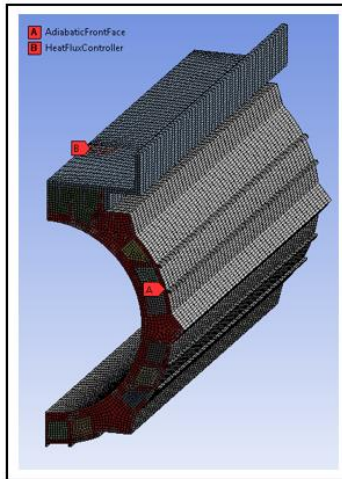


Fig9: computational Mesh for 3D simulation

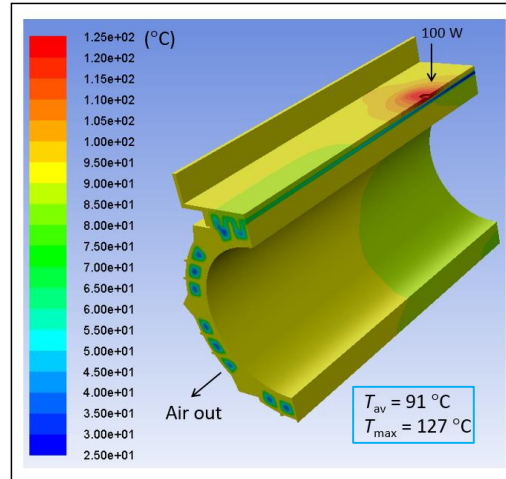


Fig10: Temperature distribution for $v = 5 \text{ m/s}$

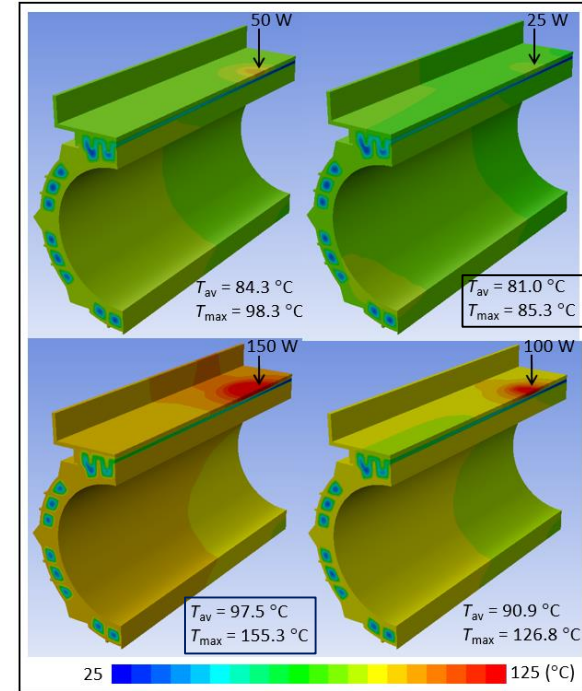


Fig11: Temperature distribution for different power outputs from the chip

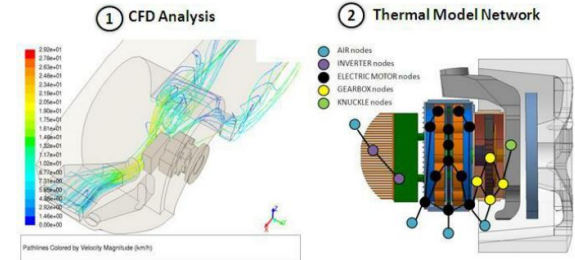
Research pitch and its relevance (4/4)

1

The research enables decision making on the design before going into manufacturing

2

The design procedure is useful for any industries/manufacturers who are needing to develop or optimize cooling systems for electric motors



THANK
YOU

Regards,

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