HighEFF

FME FORSKNINGS-SENTER FOR MILJØVENNLIG ENERGI
Norges forskningsråd

CFD modeling of ice formation and melting in horizontally cooled and heated plates

Håkon Selvnes

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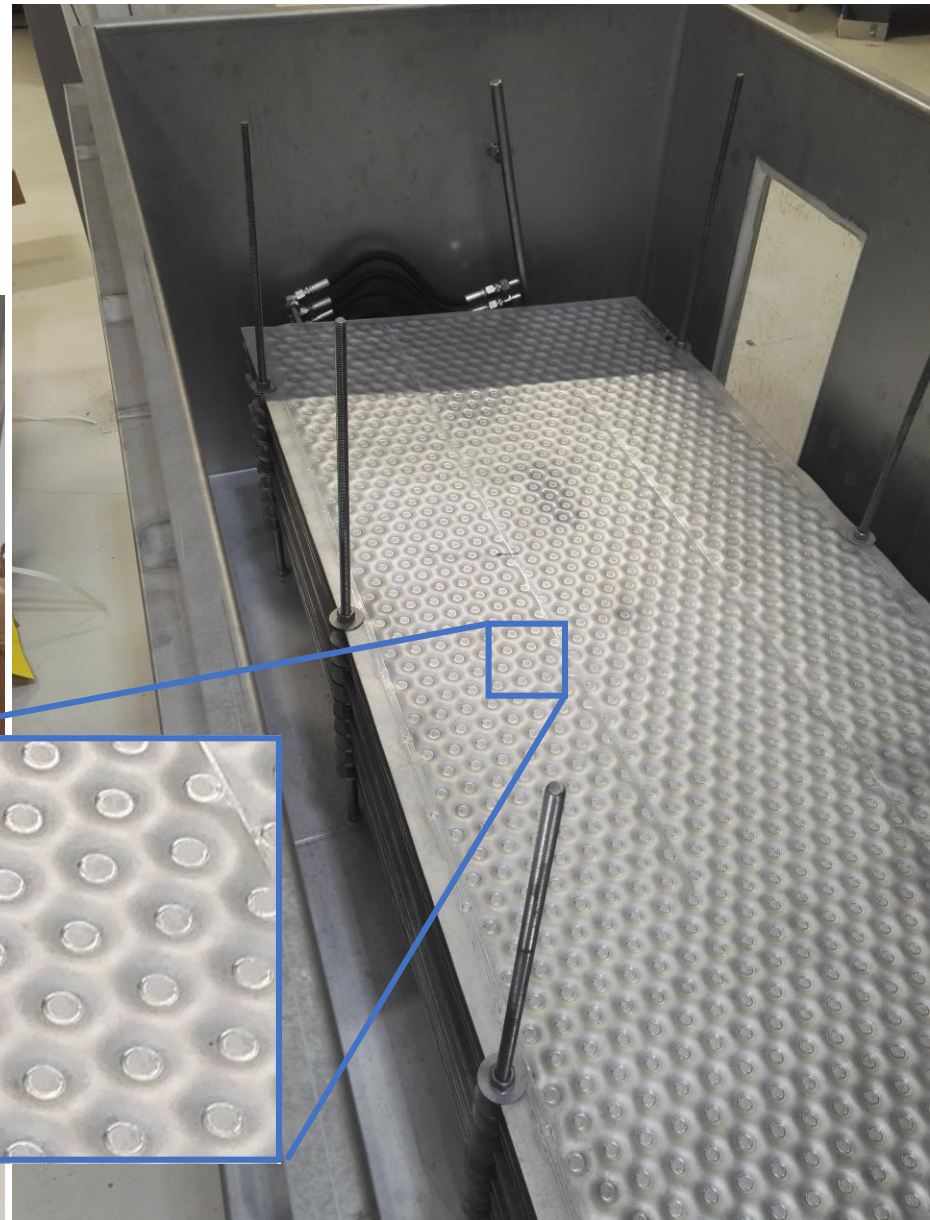
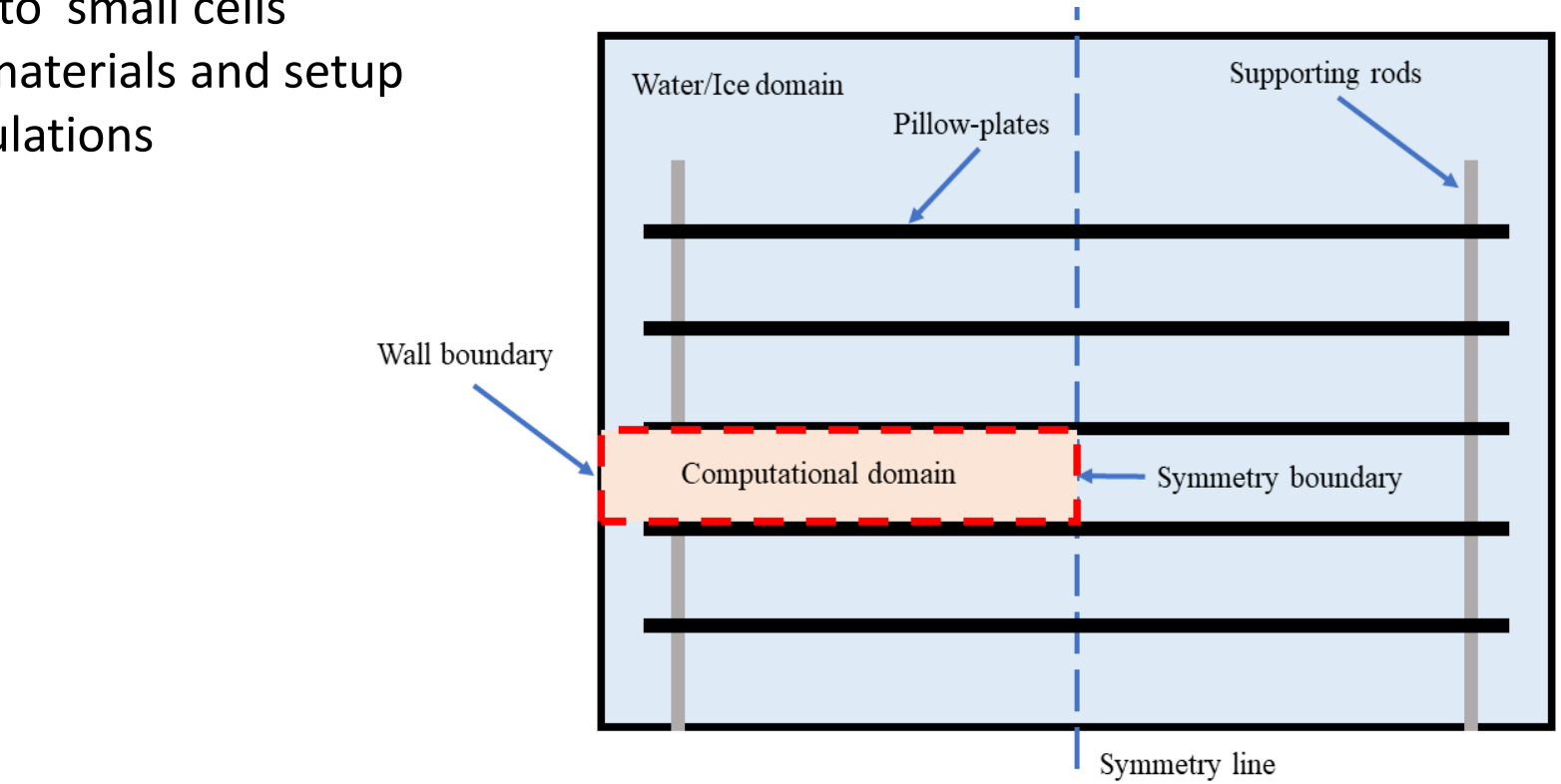
Background of study

- Novel cold thermal energy storage unit
- Developed together with Skala Fabrikk AS
- Pillow plate design
- Norsk kylling AS / REMA 1000 AS



Method: Computational fluid dynamics

1. **Select and create a geometry**
2. Divide into small cells
3. Specify materials and setup
4. Run simulations



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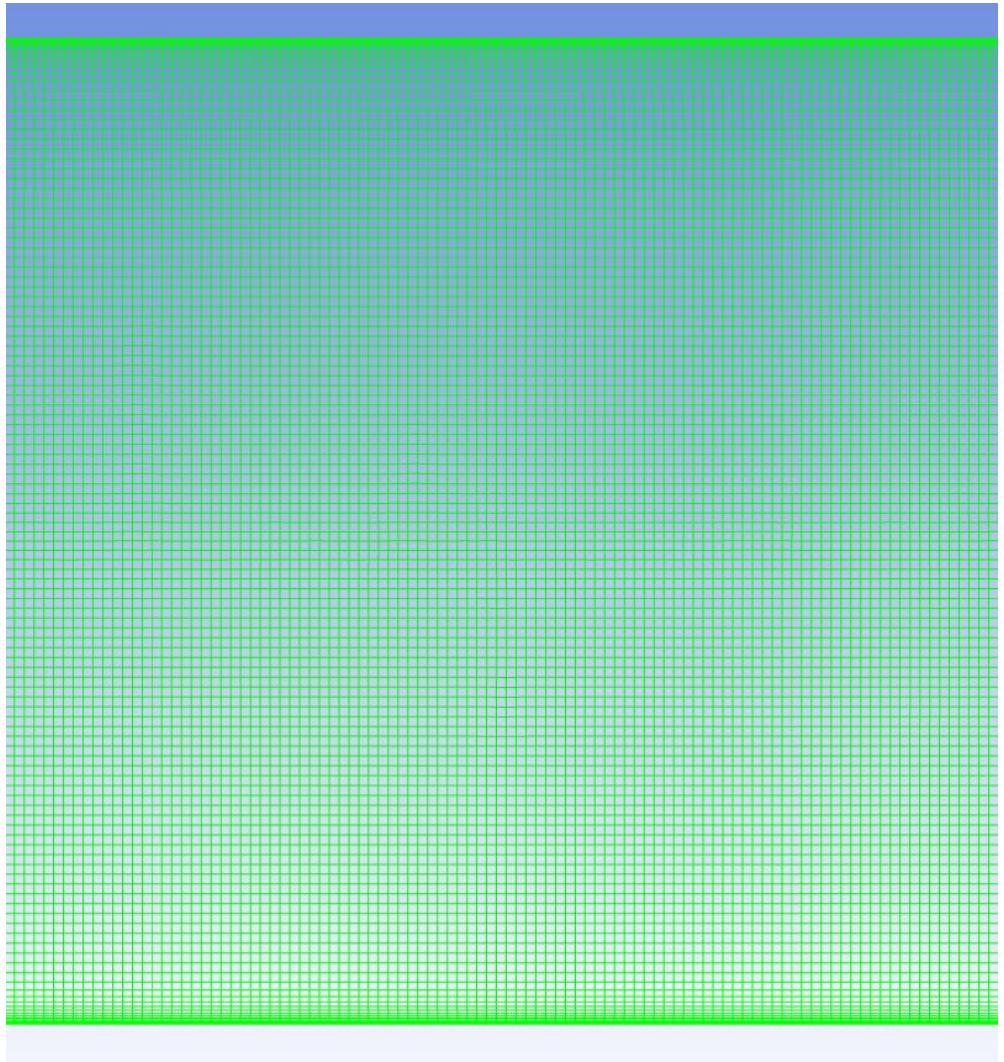

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Property	T < -0.49°C / T < -0.99°C (solid)	ΔT_{pc}	T > 0.01°C (liquid)
Thermal conductivity	1.918 W m^{-1} K^{-1}	-	0.579 W m^{-1} K^{-1}
Specific heat capacity	2217 J kg^{-1} K^{-1}	-	4180 J kg^{-1} K^{-1}
Density	917 kg m^{-3}	-	(Eq. 1)
Viscosity	-	-	0.001003 kg m^{-1} s^{-1}
Heat of fusion	-	333.55 kJ kg^{-1}	-

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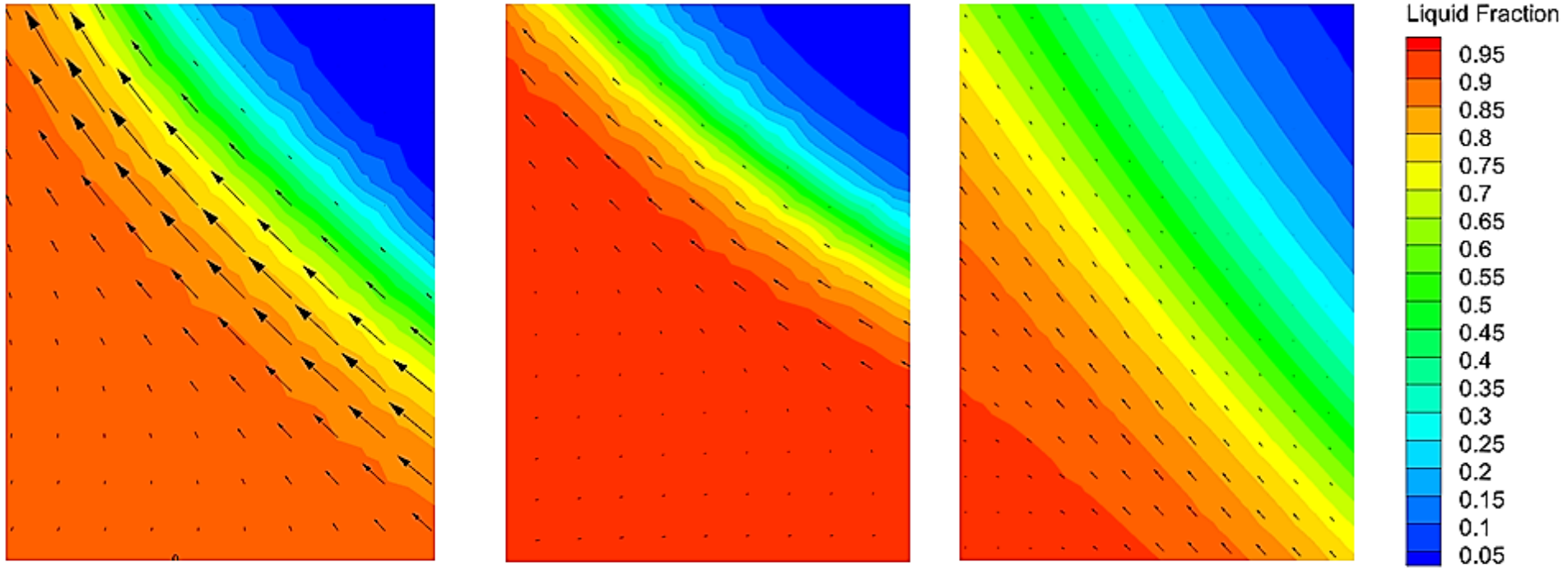
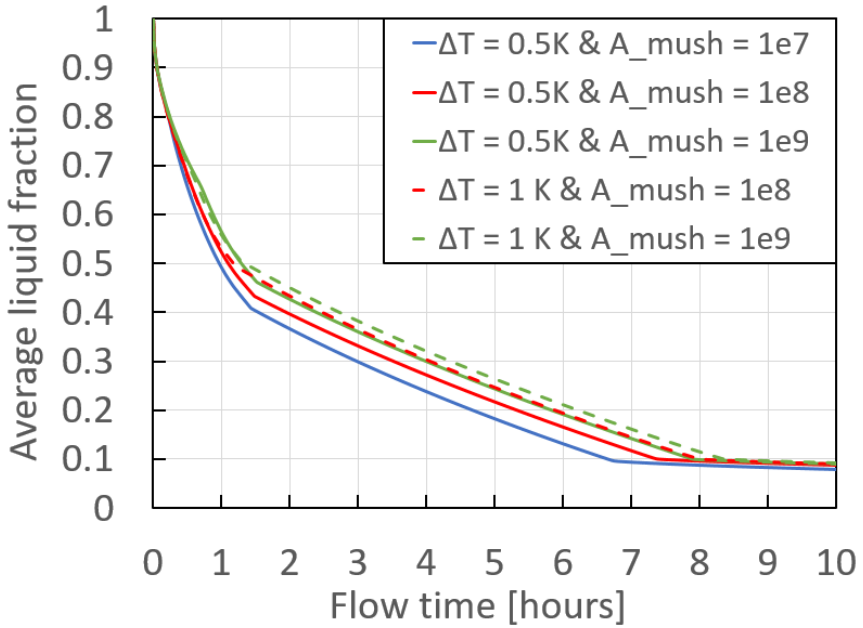


Some results

- Energy stored in unit during charging



	Latent heat energy stored in unit [kWh]						
Flow time [hour]	0.5	1	2	4	6	8	10
A_{mush}= 10^8 ΔT= 0.5 K	37.62	56.42	71.30	86.01	98.59	106.78	107.77
A_{mush}= 10^8 ΔT= 1 K	37.93	55.34	66.93	82.31	95.23	106.29	107.51

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Thank you for the attention!

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