TECHNISCHE UNIVERSITÄT DRESDEN

Faculty of Mechanical Science and Engineering Bitzer Chair of Refrigeration, Cryogenics and Compressor Technology

Refrigeration technologies

Academic investigation in future topics

SolidCool

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The “SolidCool”-research project was initiated to validate **alternative cooling concepts** for refrigeration applications **below -50 °C** (223 K). The currently most commonly used refrigerant for those applications is Trifluoromethane (R23) with an enormous global warming potential (GWP100 = 14800). A suitable substitute can be found by using the enthalpy of **sublimation** from solid **CO_2** (dry ice). Special investigation issues are focused on **clogging effects** of the **expansion devices** and **heat transfer**.

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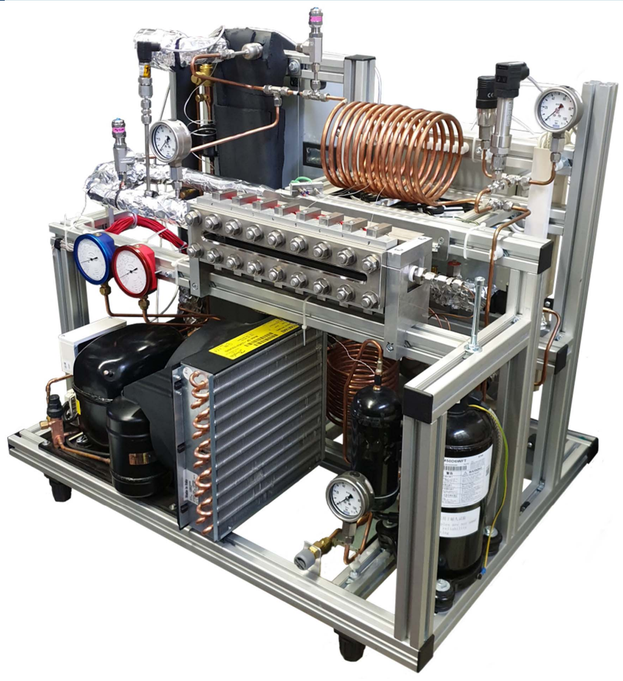

Figure 1: Table-top demonstration unit for CO_2-sublimation cycles

WÜSST

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The application of **ice slurry** as a coolant for energy distribution or as PCM in **thermal storage systems** can increase the efficiency of refrigeration systems. One of the key factors therefor is a specific **plate heat exchanger design** for ice-water **two phase flow**. The prediction of possible agglomeration of solid particle which lead to the blocking of channel is of great importance. Within the “WÜSST”-research project an enhanced understanding of fluid-flow and heat transfer processes, based on **numerical models**, is generated. With this data **new design approaches** of ice slurry heat exchangers can be created for further **experimental investigations**.

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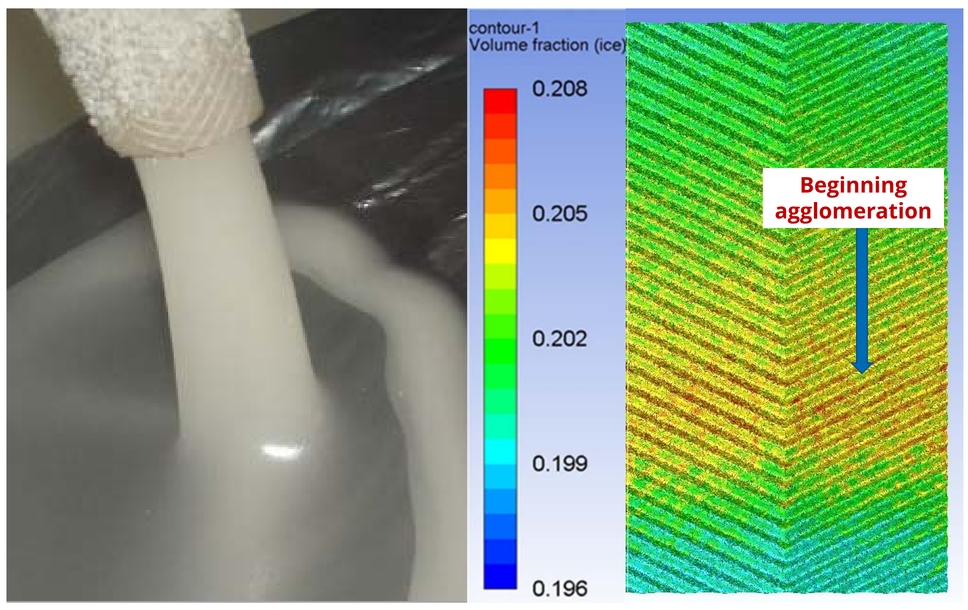

Fig. 2: left: Pumpable ice slurry (source: www.iceandoventechnologies.com)
right: Numerical CFD study of blocking of ice slurry in a plate heat exchanger

Feutron-ecoKPK

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Common **environmental and climate test chambers** often use HFC-refrigerant blends like R404A and R507 to provide temperatures down to -40 °C. In order to circumvent the **restrictions** of the **HFC-regulations**, **CO_2** is used as **alternative refrigerant** within this research project. A new system operates as **cooling** and **heat-pump** cycle and substitutes the ordinary electrical heaters, which are used for heating during temperature test cycles. The CO_2-process can also provide **big temperature changing rates** down to **-50 °C** and enhances the overall system **efficiency**.

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Fig. 3: Test rig of an environmental test chamber using CO_2 as refrigerant for cooling and heat-pump operation