UAA College of Engineering
University of Alaska Anchorage

UAA Professional Development Seminar Series

Refrigeration and Compression Processes in Cold Climates

Presented by Dr. Eivind Brodal, Assistant Professor UiT

Alaska and Norway, where I come from, have much in common, such as a cold climate and large fishing and oil/gas industries. This talk will focus on my research related to these similarities. The low ambient temperatures typical of the Arctic are potentially beneficial in some industrial applications, such as cooling in liquefied natural gas (LNG) production and carbon capture and storage (CCS) processes. To take full advantage of the benefit of low ambient temperature in energy-intensive processes, and to compare systems located in different climates fairly, numerical modeling and optimization techniques have been used to explore different processes. The results show that the energy efficiency and optimal design of such systems depends strongly on the ambient temperature, giving performance advantages for systems in cold climates.

Energy efficient heat pumps and cooling systems for cold climates, based on CO_2, have also been explored, and some of these results will be presented. The refrigeration industry is currently focusing on the development of new processes using natural and environmentally friendly refrigerants such as CO_2, which has a low global warming potential compared to traditional refrigerants. In low ambient temperature operating environments, CO_2 offers particularly competitive performance characteristics for refrigeration processes and heat pump processes used for tap water heating. Contact freezers and refrigerated seawater (RSW) chillers are both important conservation methods in onshore and marine installations that rely on refrigeration. CO_2 based RSW for fishing vessels is a relatively new technology. The first commercial system in the world was installed by a company based in my hometown Tromsø in 2010. Also, CO_2 based contact freezers can operate at very low temperatures (-50 °C), which can reduce the freezing time with 50 %, lowering costs and increasing the quality of the product.

Eivind Brodal is an assistant professor at UiT The Arctic University of Norway. He was born in 1977 and received a MD in theoretical nuclear physics in 2003 from the University of Oslo. In 2008, he finished his PhD at UiT, where he investigated and modeled ultrasound systems. In 2009 he started teaching general thermodynamics and a more specialized course about heat pumps and refrigeration units at UiT. His main interests now are to investigate advantages gained in cold regions like Tromsø and Anchorage, and to model, modify, optimize, and improve heat pumps and refrigeration processes using environmentally friendly refrigerants such as CO_2.

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