

Einladung zum Vortrag am 16. September 2025 – 16 Uhr

Seminarraum 029 - Gebäude 8142 (CMG)

Referent: Prof. Eckhard A. Groll – Purdue University

## Development of a High Temperature Heat Pump System with Internally Cooled Screw Compressors

Institutsleitung:  
Prof. Dr.-Ing. M. Richter  
Tel. +49 511 762 2277  
Fax +49 511 762 3857  
E-Mail: m.richter@ift.uni-  
hannover.de

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Authors: Eckhard A. Groll, Davide Ziviani  
University: Purdue University, School of Mechanical Engineering,  
Ray W. Herrick Laboratories, West Lafayette, IN, USA  
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### Abstract

High temperature heat pumps (HTHPs) have proven to be a leading technology to improve the efficiency of industrial processes through heat recovery and revalorization. However, there are still barriers to the broader adoption of HTHPs. The lack of standardized system designs and refrigerants has led to payback periods that exceed industry expectations, and industry is wary of adoption without long-term performance data. Additionally, achieving vapor-compression-based HTHPs with supply temperatures up to 200 °C is dependent on the temperature lift, application, and refrigerant choice. A holistic approach is needed that integrates fluid, component, and system aspects of HTHPs to pursue new pathways.

This presentation will provide an overview of the ongoing research efforts at the Ray W. Herrick Laboratories to develop a novel internally cooled screw compressor for a HTHP to achieve supply temperatures of 200 °C, temperature lifts from 50 to 100 K, and 50% or more of COP<sub>Carnot</sub>. The proposed technology and integrated approach will address several major challenges related to HTHPs, including demonstration of a compressor technology suitable for high temperatures, identification of stable refrigerants with suitable critical temperatures, implementation of techniques to mitigate adverse effects of fluctuating heat sources and exergetic heat transfer losses, and quantification of trade-offs (e.g., performance, costs) for HTHPs in industrial applications from 150–200 °C. This will set a solid foundation for long-term impact in industrial heat pumps by improving high temperature operation as well as increasing system efficiency and flexibility.

Besucheradresse:  
Institutsgebäude 3  
(Gebäude 8143)

An der Universität 1  
30823 Garbsen  
www.ift.uni-hannover.de