OAK RIDGE National Laboratory | BUILDING TECHNOLOGIES RESEARCH AND INTEGRATION CENTER

Flow Heat Transfer and Pressure Drop for Low-GWP Refrigerants

Yifeng Hu, R&D Associate Staff (huy1@ornl.gov); Samuel F. Yana Motta, Distinguished R&D Staff; Cheng-Min Yang, R&D Associate Staff; Brian Fricke, Group Leader; Kashif Nawaz, Section Head

Research Challenges

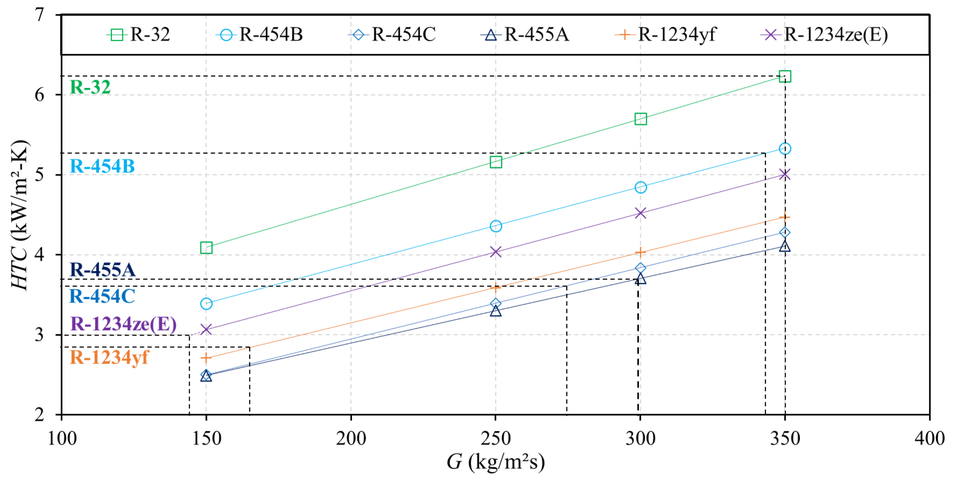
- Absence of experimental data for low-GWP refrigerants in micro-fin expanded aluminum tubes
- Lack of heat transfer data for low-GWP refrigerant blends with high temperature glide
- Existing models developed for single components or blends with low to moderate temperature glide in unexpanded micro-fin copper tubes
- Uncertainty of effectiveness of models for new low-GWP refrigerants, especially with high temperature glide

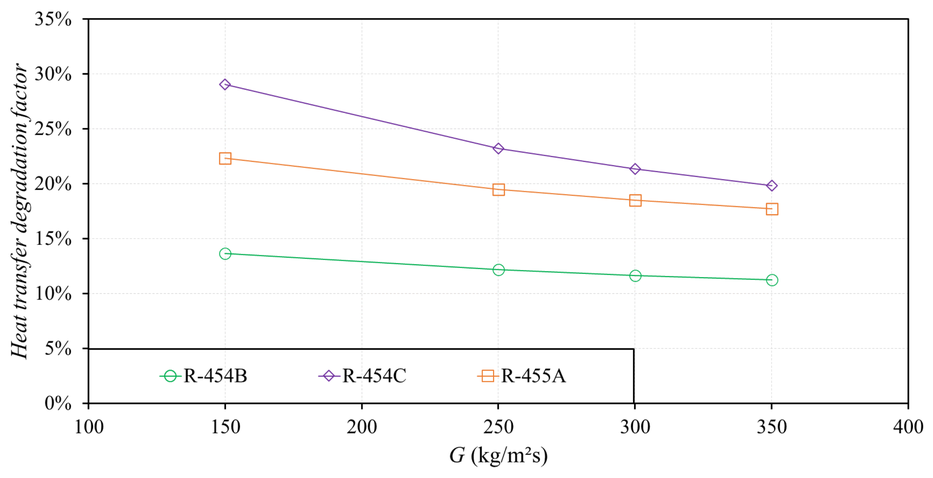
Current Research

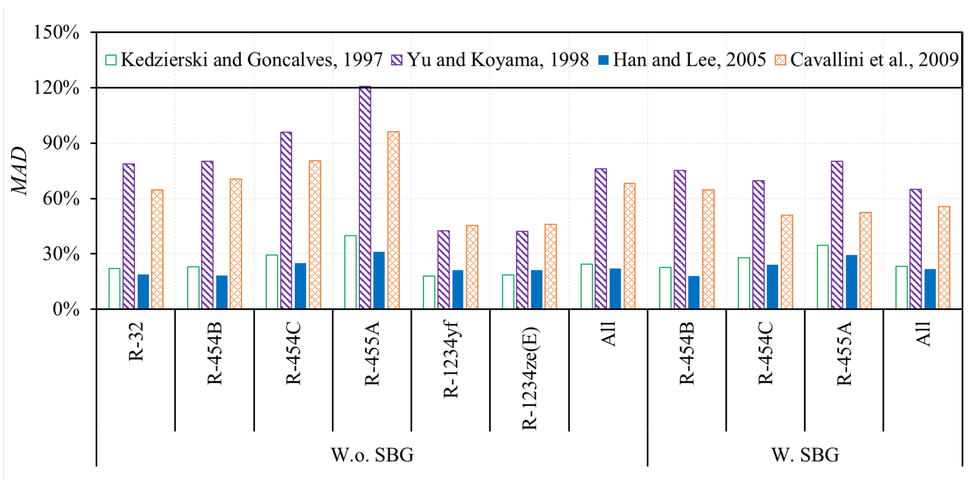
- Flow condensation was conducted for an expanded axial micro-fin aluminum tube
- R-32, R-454B, R-454C, R-455A, R-1234yf, and R-1234ze(E) were tested
- Four existing heat transfer models and four pressure drop models were evaluated
- Three heat transfer models underwent optimization

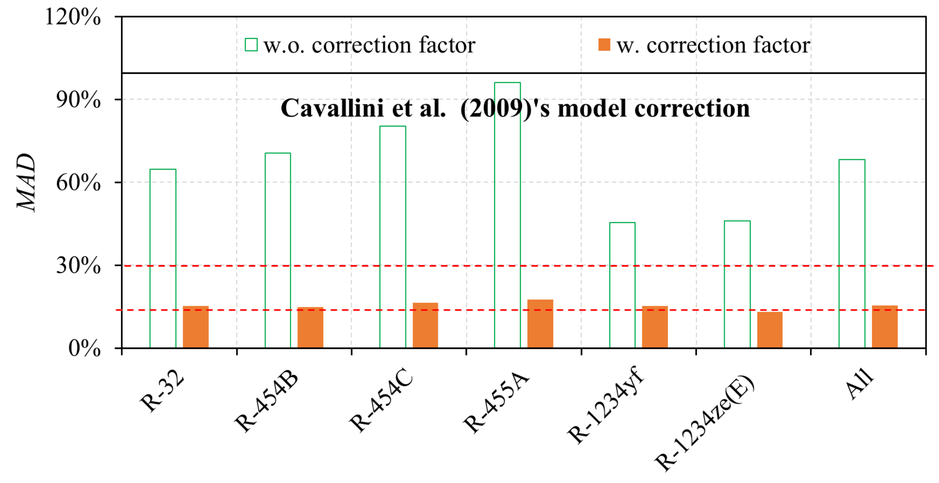
Planned/Future Research

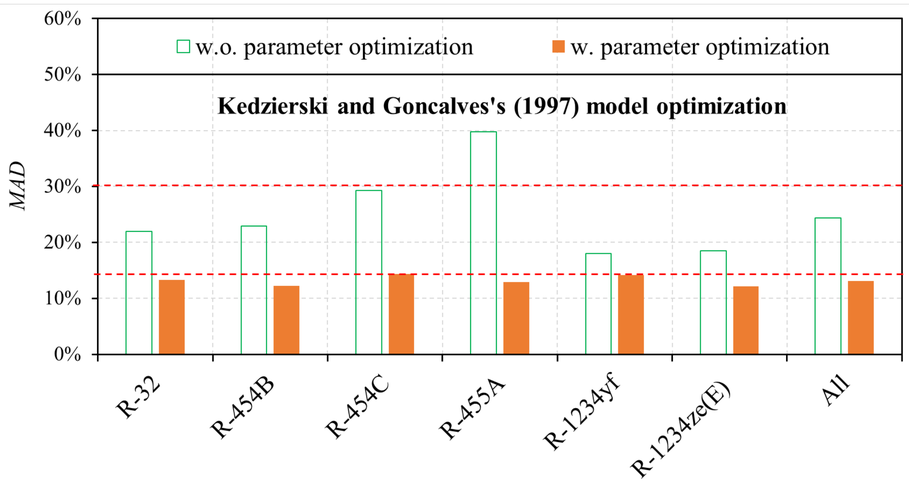
- The equivalent saturation temperature drop method was used for refrigerant comparison
- High-glide refrigerant blends show heat transfer coefficient degradation of up to 30%
- Two methods—correction factor and parameter optimization—were used to enhance model performance
- Future research will concentrate on the refrigerants' flow boiling characteristics











1. Hu, Y., Jajja, S. A., Yang, C. M., Yana Motta, S. F., Fricke, B. A., and Nawaz, K. (2024). In tube condensation of low global warming potential refrigerants in an axial micro-fin aluminum tube. *Int. J. of Refrig.*, 161, 221–241.
2. Hu, Y., Yana Motta, S. F., and Yang, C. M. (2024). Evaluation and development of flow condensation correlations using the data from low-GWP refrigerants in an axial micro-fin aluminum tube. *Int. J. of Refrig.*