

Lab Tests Prove that Microgrooves Greatly Increase Local Heat Transfer Coefficients Inside Small Tubes of Copper, Says International Copper Association

ICA Research Findings have Immediate Application in Coil Designs for Energy-Efficient Consumer Appliances such as Room Air Conditioners

New York, NY (October 29, 2010) — One of the most exciting recent developments in heat exchanger coil design is the outstanding performance of microgroove-enhanced, small-diameter copper tubes. The International Copper Association (ICA) today announced laboratory test results on small-diameter copper tubes with and without enhanced inside surfaces. The results prove that grooving the inner surfaces greatly increases the local heat transfer coefficient inside such “microgroove” tubes.

“The inner grooves stir the refrigerant as it passes through the tubes,” says Wenson Zheng, Deputy Director of Technology for ICA. “Such stirring is crucial to efficient heat transfer.” According to Mr. Zheng, the effects of inside-tube surface enhancements are well understood from fluid mechanics theory. Nonetheless, hard experimental data on small-diameter copper tubes is essential to the design of advanced coils for ACR products with high energy efficiency.

The laboratory experiments were performed at the Institute of Refrigeration and Cryogenics at Shanghai Jiao Tong University (SJTU) in Shanghai, China. The research was co-sponsored by the International Copper Association. The tube sizes that were selected and tested were the small diameters of special interest to OEMs. “They are at the sweet spot in coil design,” says Zheng, “Heat-transfer coefficients are high yet pressure drops are still manageable.”

R410a was the refrigerant tested in the copper tubes of various small diameters, with and without enhanced inner surfaces. Other parameters such as refrigerant flow rate, vapor quality and oil concentration were carefully controlled. The data on tubes with smooth surfaces provides a baseline for comparison. “With all other factors being equal, very pronounced increases in the local heat transfer coefficient are plainly evident for the tubes with micro-grooving compared to smooth tubes,” says Zheng.

These data along with proposed models that fit the data can be used to simulate heat exchanger performance and bring new products to market. OEM members of the research consortium have already designed consumer products, such as room air conditioners, using small tube copper with microgrooves, and these products are being introduced into global markets.

Experimental results and other technical materials are available online at www.microgroove.net. For more information about heat exchanger coils made with small tube copper, visit www.microgroove.net.

About ICA

The International Copper Association, Ltd. (ICA) is the leading organization for promoting the use of copper worldwide. ICA’s mission is to promote the use of copper by communicating the unique attributes that make this sustainable element an essential contributor to the formation of life, to advances in science and technology, and to a higher standard of living worldwide. Visit www.copperinfo.com for more information about ICA.

About Shanghai Jiao Tong University

Shanghai Jiao Tong University (SJTU) was founded in 1896 and is one of the oldest universities in China. Through its century-long history, SJTU has nurtured many outstanding figures and made significant contributions to science and technology. Today SJTU boasts 20 academic schools. It has 60 undergraduate programs, 152 masters-degree programs, 93 PhD programs and 16 post-doctorate

programs. There are 16 State key doctorate programs and 14 State key laboratories and National engineering centers. The Institute of Refrigeration and Cryogenics at SJTU is renowned for its world-class research in air-conditioning and refrigeration. Visit www.sjtu.edu.cn for more information about SJTU.

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