microgroove™ Update

Attain High Energy Efficiency with Less Materials Using Smaller-Diameter, Inner-Grooved Copper Tubes

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LATEST MICROGROOVE RESEARCH IS READY FOR PRESENTATION AT INTERNATIONAL CONFERENCES

Figure 1. Photograph from ACREX.

NEW ACR APPLICATIONS RECENTLY ON EXHIBIT AT MAJOR EXPOS

New applications for MicroGroove smaller-diameter copper tubes continue to be developed by OEMs around the world. Technical papers are being readied for presentations at international conferences, including the IEA International Heat Pump Conference in Montreal in May and the Purdue Conferences in July.

You can read more about those technical papers later in this issue; but first, here is a brief recap of recent expositions. MicroGroove attracted a lot of attention with its exhibits at major trade shows already this year.

INTERNATIONAL EXPOSITIONS

In the last three months, MicroGroove circled the globe with exhibits at three major expositions, including the AHR Expo in New York City, ACREX India in New Delhi and the China Refrigeration Expo in Beijing.

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PRESENTATIONS

TECHNICAL PAPERS

Eleventh International Energy Agency Heat Pump Conference

May 12–16, 2014
Montreal, Canada

A technical paper on MicroGroove technology will be presented in the Day 1 session on Technology Advances – Components

Fifteenth International Refrigeration and Air Conditioning Conference

Jul 14–17, 2014
West Lafayette, Indiana

Technical papers on MicroGroove technology will be presented.

EXHIBITIONS

International Energy Agency Heat Pump Conference

May 12–16, 2014
Montreal, Canada

Visit the MicroGroove Exhibit
www.iea-hpc2014.org/

More Info on the "Events" Page

www.microgroove.net/events

NEW BROCHURE

All Copper Coils: Economical, Eco-friendly & Hygienic

Available for downloading from Overview section of www.microgroove.net/antimicrobial-copper

http://www.microgroove.net/sites/default/files/6436_all_copper_antimicrobial_flyer_7.pdf

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AHR Expo

Despite the winter storm in New York City coincident with the AHR Expo, the show was well attended and interest in MicroGroove was high at the Javits Center. Visitors to the MicroGroove booth expressed interest in using MicroGroove for a wide range of applications including refrigerated transport, R744 coils and commercial and industrial applications, where the smaller diameter copper tubes offer higher efficiencies, compactness and reduced refrigerant volumes as well as excellent durability.

Figure 2. Photograph from China Refrigeration

Companies such as Cancoil Thermal Corporation (Kingston, Ontario), Lordan (Kfar Szold, Israel) and Super Radiator Coils (Richmond, Virginia) displayed their latest product designs featuring MicroGroove tubes.

Cancoil presented its new commercial-sized condenser made with MicroGroove technology. The condenser was fully assembled with fans and frame around a large MicroGroove coil provided by its partner company SPIROTECH. Cancoil is well known in North America for its heat exchanger designs, which are used in a wide range of commercial applications.

Lordan displayed a variety of heat exchanger coils made with MicroGroove technology. One of the first companies to adopt MicroGroove copper tubes, Lordan supplies MicroGroove coils for countless refrigeration, AC and heat pump applications. It has published a new brochure titled "The LORD FIVE compact advantage," which is specifically about the advantages of coils made with 5-mm copper tubes.

Super Radiator Coils showed off its MicroGroove designs at its own booth and the MicroGroove booth. Organized by the Copper Development Association, the MicroGroove booth displayed a commercial-sized MicroGroove coil as well as a large all-copper coil, both courtesy of Super Radiator Coils; as well as a variety of smaller MicroGroove coil designs designed for residential products currently in production for global markets.

ICA members who are suppliers of MicroGroove tubes were also highly visible at their respective booths. For a listing of suppliers of copper tubes for ACR applications, visit the MicroGroove Supplier Directory online here: www.microgroove.net/supplier-directory

ACREX India

MicroGroove made its ACREX India debut with its own booth at Pragati Maidan, New Delhi. Companies such as the Lu-Ve Group (Uboldo, Varese, Italy) and SPIROTECH (New Delhi, India) also displayed products made with smaller diameter copper tubes.

The Lu-Ve Group exhibited its new NanoGiant® condensers with MINICHANNEL® coils, a product described in a previous *MicroGroove Update* (Vol. 3, Issue 3).

SPIROTECH Company chairman Dr. R.K. Malhotra was present at ACREX India at the SPIROTECH booth and the MicroGroove booth. SPIROTECH makes a wide range of coils for small appliances as well as large coils for condensers and commercial applications. Last year, SPIROTECH announced a new production facility dedicated to the manufacture of coils with smaller-diameter copper tubes as described in a previous *MicroGroove Update* (Vol. 3, Issue 2).

SPIROTECH received a Special Mention for the "ACREX Award of Excellence" in the Green Product category, specifically for its 5-mm copper tube heat exchanger coils. The nomination pointed out that the coils can be used in all the HVAC&R products which use new generation refrigerants; and, in particular, in products using natural refrigerants such as propane (R290), isobutane (R600a) and carbon dioxide (R744). "Our in-house cycling test has revealed that 5-mm coil qualifies for use with the high design pressure requirement of R744," says Dr. Malhotra. "We have applied to Underwriter Laboratories (UL) for an official safety certification for 5-mm tube coils."

China Refrigeration

MicroGroove was on display for the fourth consecutive year at the China Refrigeration Exposition. This year in Beijing, the focus was on natural refrigerants such as propane as well as "all copper" antimicrobial coils. A new software package for the design of refrigeration equipment was demonstrated.

The ICA exhibit was divided into two sections, highlighting the following technologies: 1) MicroGroove in refrigeration equipment and residential AC products, and 2) the superior long-term performance of antimicrobial "all copper" coils. Each of these application areas was promoted under the ICA banner at the China Refrigeration Exposition, emphasizing the many areas of market penetration for copper tubes.

Coils made with copper fins and copper tubes offer extraordinary antimicrobial properties. These "all copper" coils prevent various bacteria and fungi from multiplying on coils, thereby inhibiting the buildup of biofilms. Coils stay cleaner for longer periods of time and consequently high levels of heat-transfer efficiency can be maintained for longer periods of time. See the "In the Spotlight" section for more about the use of antimicrobial coils in HVAC products.

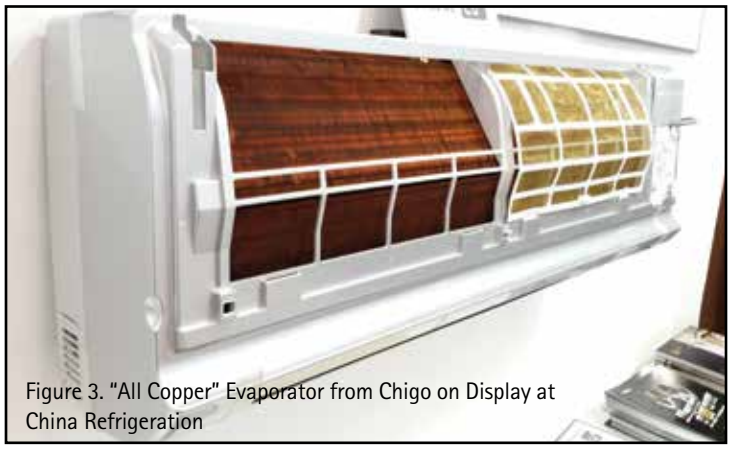

Figure 3. "All Copper" Evaporator from Chigo on Display at China Refrigeration

"China continues to pave the way in advancing the use of copper in HVACR applications," said Nigel Cotton, MicroGroove Team Leader for ICA. "These advances are driven by cost-performance, and the capability of making smaller-diameter tubes from copper including copper's inherent antimicrobial properties."

INTERNATIONAL CONFERENCES

As the number of applications for MicroGroove Technology continues to grow, so too does the need for research to guide engineers in the design of industry-first products. Not surprisingly, there is a full line-up of technical papers for spring and summer conferences, beginning in May in Montreal.

IEA Heat Pump Conference

The Eleventh International Energy Agency Heat Pump Conference will be held May 12-16, 2014 in Montreal, Canada. This conference is held once every three years and is attended by researchers and policy makers from all over the world.

Heat pump technology has taken great strides both in terms of technology development and market acceptance. The efficiency of heat pumps compared to other approaches to heating has earned the technology a place in the minds of policy-makers intent on reducing carbon dioxide emissions by increasing the energy efficiency of systems for air conditioning, refrigeration and heating.

MicroGroove will have a table-top exhibit at the IEA HPC conference in Montreal. If you are planning to attend this conference, then please stop by and say "Hello." The same advantages that apply to air-conditioners and refrigeration equipment also apply to the evaporator and condenser coils used in residential heat pumps, including hot-water heat pumps as well as heat pumps that are used to heat indoor spaces.

Professor Guoliang Ding will deliver a technical paper titled, "Experimental investigation and structure optimization of distributors used in heat pump air conditioner with microgroove tubes." The paper will be delivered on the first afternoon of the conference in a session on "Technology Advances – Components." Coauthors of this paper include several members of the technical staff at ICA China. The paper discusses how to optimize the coil design to allow for additional branch circuits in the design of heat pumps with smaller diameter copper tubes.

You can read more about Professor Ding in the "In the Spotlight" section of a previous *MicroGroove Update* (Volume 2, Issue 3). www.microgroove.net/microgroove-update-newsletter

Purdue Conferences

Two papers about smaller-diameter copper tubes are slated for presentation at the Fifteenth International Refrigeration and Air Conditioning Conference which will be held from July 14-17 on the campus of Purdue University. Papers from China include "Investigation of application of suction-line heat exchanger in R290 air conditioner with small diameter tube" by Tao Ren *et al.*; and "Influence of oil on heat transfer characteristics of R410A flow-boiling in conventional and small size microfin tubes" by Haitao Hu *et al.* Authors include ICA technical staff as well as researchers from the Institute of Refrigeration and Cryogenics, Shanghai Jiao Tong University; and the Key Lab of HVAC, Beijing University of Civil Engineering and Architecture.

For more information on the Purdue Conferences or to register for the conference, visit the Purdue website via www.microgroove.net/events (or directly at https://engineering.purdue.edu/Herrick/Events/2014Conf).

THE PURPOSE OF RESEARCH

As new applications are discovered and uncovered, the need for applied research increases. Yet companies engaged in such research may be reluctant to share their results because of the competitive nature of the marketplace.

The Copper Alliance and the International Copper Association continue to support research projects aimed at advancing basic technology that will lead to more efficient, safer, eco-friendly designs.

"The Copper Alliance supports the development of new applications for smaller diameter copper tubes," says Nigel Cotton, MicroGroove Team Leader for the International Copper Association. "A variety of research on tubes and coils as performed by the consortium frees up resources for individual OEMs and frees their technical staff to focus on product development. We look forward to continuing our relationship with industry to encourage the use of copper in the development of efficient and eco-friendly products."

Join the MicroGroove Group on LinkedIn to share your ideas about research directions and product development. www.linkedin.com/groups/Microgroove-4498690

MICROGROOVE IS ONLINE

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CHIGO NOW OFFERS SPLIT SYSTEM WITH "ALL COPPER" EVAPORATOR COILS

ANTIMICROBIAL PROPERTIES PROLONG LIFE AND REDUCE ODORS

Chinese OEM giant Chigo is now making residential air conditioning products with an option for "all copper" coils. The goal is to improve evaporator performance, by reducing the buildup of organic material on the fins, and also to reduce odors.

In cooperation with the International Copper Association, Chigo began test marketing antimicrobial copper room air-conditioners in 2012. The initial 200 sets quickly sold out and the market survey was positive. Consumers responded favorably to the antimicrobial copper products and the concept of antimicrobial copper.

More recently, in cooperation with ICA, Chigo has begun marketing split-unit room air-conditioners equipped with antimicrobial copper filters. Ten thousand units were officially introduced into the market at the close of 2013 in twelve cities of five provinces in China. Initial sales will be through the "Five Star" appliance channel, a wholly owned subsidiary of Best Buy Co., Inc.

Each air-conditioner unit consists of two pieces of a filter made with 200 grams of brass wire. Its antimicrobial performance was tested effectively by SGS-CSTC Standards Technical Services Co., Ltd (SGS) under GB 21551.2-2010.

Given the positive response of the marketplace to the use of antimicrobrial copper components, Chigo will next expand their use to broader markets and more air-conditioners types.

BYE-BYE MUSTY SMELLS

It has long been realized that aluminum coils in automotive systems can emit a bad odors [1-3].

Recognizing the advantages offered by an "all-copper" evaporator coil, Chigo has been studying the performance of such coils in transportation systems. Exploring the potential of these systems, the Shanghai Municipal Center for Disease Control and Prevention (SCDC) undertook testing between 2010 and 2012. Buses operating in similar conditions (e.g. time and location) were fitted with coils made with either copper or aluminum fins, and the level of contamination on each was monitored. They found that microbial levels on the copper surfaces were significantly lower than those on the aluminum.

Chigo now offers an "all copper" coil option for residential air-conditioner systems. This technology was well received at the China Refrigeration Exposition in Beijing, where it was on display by the International Copper Association, adjacent to the MicroGroove Booth.

ANTIMICROBIAL COPPER

Perhaps the reason why "all-copper" coils smell better than aluminum and last longer has to do with the proven antimicrobial properties of copper. Extensive laboratory testing sponsored by the ICA in recent years has proven that copper metal as well as many copper alloys have remarkable antimicrobial properties.

Results of research have received official endorsement via the US Environmental Protection Agency (EPA) "Treated Article Exemption" registration for copper alloys in HVAC applications. Granted in September 2010, the registration allows copper HVAC components to make product protection claims in the US. These products can claim to suppress the growth of bacteria, mold and mildew that reduce system efficiency and cause product deterioration or foul odors.

More about antimicrobial copper can be found on an ICA website (www.antimicrobialcopper.com) dedicated to the topic as well as on microgroove.net.

STAYS CLEANER LONGER, CONDUCTS HEAT BETTER

Along with judicious use of filters and regular maintenance, all-copper coils can be kept clean and consequently they will conduct heat and resist corrosion better compared to other types of coil materials. The musty smells and bad odors sometimes associated with air conditioning equipment can be avoided. Heat transfer efficiency is higher for a clean heat exchanger compared to one with fins and tubes that are contaminated and so energy savings is another benefit of an all-copper coil.

A four-page brochure on the benefits antimicrobial properties of all-copper is now available for downloading from the Antimicrobial "All Copper" Heat Exchanger microsite: www.microgroove.net/antimicrobial-copper

References

1. "Odor Reduction Draws Designers to Copper Brass for Mobile Air-Conditioner Applications" *CuproBraze Executive Report*, Number 56. Available online here: http://www.cuprobraze.com/pdf/CuproBraze_56.pdf

2. Mizuno, H. *et al.* (Denso), "Multifunctional Surface Treatment for Car Air Conditioners," SAE Technical Paper Series, 980284 (1998).

3. "Antimicrobial All-Copper Heat Exchangers: Economical, Eco-friendly & Hygienic," four-page brochure, available for downloading from the "Overview" section of www.microgroove.net/antimicrobial-copper