



# Building & Architecture News

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## Copper: Architecture's Green 'Enabler'

Mankind has been using copper for so long (about 10,000 years) and for so many purposes (ornaments, weapons, building materials, electronic components, etc.) that some might assume we'll soon run out of the stuff.

No need to worry. According to the U.S. Geological Survey, only a small percentage of all the world's known copper reserves have been recovered to date. Not only are there abundant reserves of this infinitely useful, attractive, reddish-brown metal, it's also virtually 100 percent recyclable—which means that almost all of the copper ever mined could, theoretically, still be in use. Practically speaking, many materials can be recycled that aren't. Copper benefits from a well developed recycling infrastructure and an economic value that drives recovery, recycling and reuse, especially of copper building products.

Copper has many attributes, but its environmental benefits make this unique metal especially desirable to architects, builders and organizations such as the United States Green Building Council (USGBC). In commercial and residential construction today, "green" is the new religion, and recyclability, recycled content, sustainability and energy efficiency are key. All of these happen to be among copper's most enduring features.

One of the principal tools employed by the green building movement is the USGBC rating system known as LEED, for Leadership in Energy and Environmental Design. The 14-year-old nonprofit organization has instituted LEED guidelines for residential and commercial construction, building operations and maintenance, core and shell development projects, and public and municipal buildings like schools.

One critical LEED standard requires that newly constructed buildings include materials containing pre- and post-consumer recycled content. Copper provides a huge benefit in that



Reclaimed scrap copper for recycling.

most of the copper products used in construction (except certain electrical materials that require highly refined virgin copper) contain a large measure of recycled content.

Because copper is so recyclable, little is ever wasted. Many building products are made of pure copper or copper alloys that contain small amounts of other elements that are easily recycled. Typically, all copper scrap is reclaimed and reused, including finished products that are discarded after completing their consumer lifecycle.

Copper is also one of nature's most efficient thermal and electrical conductors, and it helps to conserve energy in many ways. In buildings,

it is used extensively in heating systems, direct-exchange heat pumps, and solar power and hot water equipment because of its high thermal conductivity. It's high electrical conductivity increases the efficiency of lighting, electrical motors, fans and other equipment and appliances, making the building's operation more cost effective with less energy and environmental impact.

As green building principles continue to play a role in protecting the environment, copper will continue to make a significant contribution. For more information, visit [www.copper.org](http://www.copper.org). **HP**

## Copper: An Element of Good Design

Copper and its many alloys have long played an important role in the design and architecture of residential and commercial buildings. Today, more than 10,000 years after the discovery of the "red metal," new and innovative ways to utilize copper, brass and bronze are being employed, especially in interiors.

A key aspect of interior design is that it can evoke certain emotions in occupants. Copper's warm, organic, natural appearance is said to promote an atmosphere of tranquility, peace and calm. Leatrice Eiseman, executive director of the Pantone Color Institute, recently stated, "Copper and the varicolored copper alloys invite a nurturing feeling, and in the stressful times we are living in, the need to embody warmth resonates with a lot of people."

Many interior fixtures and decorative items like door handles, doorknobs, faucets and furniture embellishments are made from copper and brass. Copper countertops, range and fireplace hoods, sinks and other accessories are commonplace in many homes. It is not uncommon to find beautiful ornamental copper in commercial buildings along with accents on elevators, doorways, window frames and lighting. Recent technological developments have enabled the use of these materials in innovative ways. For example, copper and brass metal is now woven into textiles used in draperies and other furnishings.

Building occupants, particularly those with computer networks and high-end audio or home-theater setups, use copper-shielded cabling to take advantage of the metal's radio frequency (RF) shielding properties. Properly designed and constructed copper enclosures can effectively protect against RF interference, as well as from unauthorized surveillance. This type of shielding is routine for business computer users and electrical switching operations, along with hospital CAT-scan and MRI facilities.

Another benefit for architect and designers is copper's inherent antimicrobial properties. Research at the University of Southampton in England has shown that uncoated copper, brass and bronze can eliminate many common disease-causing bacteria and viruses, including some of the most deadly and antibiotic-resistant strains.

The potential for copper-based antimicrobial products is enormous. Hospitals, day-care centers, food-processing operations and public facilities are just a few of the places where uncoated copper alloy surfaces may soon become standard. Copper may soon play a critical role in the trend towards "healthy homes" that feature allergy control products and environmentally safe building materials.

The bold, natural colors and varied hues of copper, brass and bronze add style and flare to beautifully decorated homes, businesses and commercial structures. Professionals can always count on the many benefits of copper when it comes to designing their next great project. **HP**



Accessories like this copper fireplace hood enhance many of today's homes.

## Copper Rx for Sick Buildings

Just as people who have a contagious illness can seem perfectly normal, "sick" buildings may look fine on the outside, but inside the air could be teeming with germs, pollutants and irritants that may be dangerous to anyone who comes in contact.

The Occupational Safety and Health Administration estimates that up to 30 percent of all nonresidential buildings in the United States are sick or have indoor air quality (IAQ) so poor that it can adversely affect the health, productivity and livelihood of occupants. According to the consulting firm, Christopher Collets and Associates, heating, ventilation and air conditioning (HVAC) systems contribute to poor indoor air quality in more than 60 percent of all sick buildings. Specific pathogenic risks in HVAC systems include bacteria like Legionella and Mycobacterium and molds such as Aspergillus niger.

Recent studies have shown that copper components can attack the source of the IAQ prob-

lems that emanate from commercial HVAC systems. The antimicrobial nature of copper has long been recognized and put to good use. Metal surfaces made of copper or copper alloys, such as brass, bronze and copper-nickel-zinc (commonly known as nickel silver), demonstrate a natural ability to retard the growth of algae, fungus and molds, viruses and bacteria. Studies have shown that the antimicrobial properties of uncoated copper and its alloys are continuously effective and actually increase over time as the metals oxidize and tarnish.

Ongoing research by Dr. C.W. Keevil at the University of Southampton in England, funded in part by the Copper Development Association, is providing additional insight into copper's germ-fighting properties. Dr. Keevil's experiments involved placing a known quantity of mold spores on both copper and aluminum test samples, then counting the amount of viable spores over a period of time. The test for Aspergillus niger (black mold) showed that after

six hours all of the spores on the aluminum sample were still viable, while spores on the copper sample were virtually eliminated. In a follow-up test, A. niger spores in a nutrient broth were placed on copper and aluminum and incubated at a temperature of 98.6°F, which is ideal for spore germination. After 10 days, no observable spores were present on the copper sample, while the spores germinated and grew unrestricted on the aluminum sample. Experiments performed on Methicillin-resistant Staphylococcus aureus, as well as on E. coli O157:H7, and Streptococcus, all produced similar results.

Commercial HVAC systems that include copper fin and tube heat exchangers may not only help improve indoor air quality, they also offer exceptional thermal performance, durability, efficiency and lower life-cycle costs. When it comes time to specify commercial HVAC components like heat exchanger tubes, fins, filters and condensate drain pans, architects, engineers and installers would do well to remember: "Do it proper. Do it copper."

Visit [www.copper.org](http://www.copper.org) for more information on copper's antimicrobial properties and its use in commercial HVAC systems. **HP**

## Cold Fusion: Joining Copper Plumbing Without Heat



An example of a press-connect (top) and a push-connect (right) solderless fitting.

Soldering and brazing have always been the industry standard for joining copper tube and fittings, but recent innovations in solderless or "flameless" connection methods promise to change the way copper plumbing systems are designed and built, now and in the future.

Various types of solderless systems that do not require heat, solder or flux materials have been available since 1925. However, the new systems, which utilize push-connect or press-connect fittings, are the first to imitate closely the compact, inexpensive, ease-of-use of standard, compact, inexpensive, soldered copper fitting.

Solderless push-connect and press-connect systems can be used for most plumbing applications including cold and hot water distribution, hydronic heating and cooling, compressed air, inert gases and fuel gas systems. Joints made using these systems are capable of withstanding the pressure and temperature ranges common to both residential and commercial building systems, and fittings are available in standard diameters from one-half inch to two inches and larger.

There are many benefits to using solderless fittings. Joints can be made with water in the tubing, making them ideal for emergency repairs. Unlike soldered and brazed joints, solderless connections can be pressure-tested immediately after the joint is fabricated. Because flame is not used, burn permits or a "fire watch" are not necessary during installation. More importantly, system modifications can be made without fear of discoloration or damage to nearby building finishes or components.

There are potential cost savings as well. While solderless fittings are more expensive than stan-

dard fittings, the work of joining and testing goes faster; which can provide significant reductions in labor costs. Also, as more plumbers adopt the new systems, competition among manufacturers and economies of scale should help to reduce the cost of materials and tools.

In press-connect solderless systems, fittings with integral O-rings are placed onto the copper tubing and a special tool is used to clamp them permanently in place. Different systems are available with O-rings at the center of the fitting socket or close to the end of each opening. The tools required typically can be used only with one brand of fittings.

Push-connect systems do not require special tools to make the connections, and in some cases can be easily removed and reinstalled without damaging the connection. The copper tubing is inserted into the fitting until it engages a retaining ring that grips it tightly. Elastomeric gaskets at each end of the fittings further compress the fitting to the tube. Fittings have internal stops or sleeves and washers to aid in positioning and aligning the tubing.

Solderless fittings are expected to continue to attract converts among plumbing and piping professionals looking for another tool in their bag to optimize their installation of copper piping systems. With the variety of quality joining options available, soldered, brazed, compression, grooved and the new push-connect and press-connect joining systems, there is no more adaptable, long lasting and reliable piping system than copper.

For more information on the use of solderless fittings for joining copper tube, visit the CDA website at [www.copper.org](http://www.copper.org). **HP**

## Austin City Hall Goes Green with Copper

If pennies were still made of copper (they are copper-coated zinc now), more than 12 million Lincoln coins would have been needed to construct the new City Hall in Austin, Texas.

With its multiple angles and sharp curves, the unique four-story structure is clad almost entirely in brown-gold copper. Approximately 66,000 square feet of copper was used for the interior and exterior facades of the 115,000-square-foot building, which opened in late 2004 and cost \$56 million to construct.

Recognized as an artistic as well as architectural achievement, Austin's City Hall is a contemporary tribute to the city's storied past, but one that "lives" very much in its present environment while anticipating future change. Its design, by Pritzker Prize-winning architect Antoine Predock, draws heavily on the area's culture, landscape and environment to reflect the city's organic, growing, vibrant nature.

To retard the natural patination process that gradually transforms copper's shiny russet finish to dull brown and eventually to a soft, gray-blue green, a light oil coating was applied to the exterior cladding. Predock reportedly did this so the building would slowly accumulate the signs of aging and wear and tear, to better incorporate it into its natural surroundings. Specific areas of the copper interior wall and ceiling surfaces were alternately oiled

to maintain their shine, chemically prepatinated to bring out the green color, or left to age and change naturally over time.

According to Paul Feahlu, Predock's associate and the lead designer on the project, "The great thing about copper, as it relates to Antoine's process, is that you see it age. Architecture moves through time, and copper allows you to see the building's time travels."

Inside the building, meeting and conference rooms are separated by glass partitions, evoking the open government and public accountability Austinites take pride in. In the auditorium that houses the City Council chamber, copper "clouds" on the walls and ceiling are both decorative and functional. While helping to create a more intimate setting within the large hall, the clouds also diffuse sound and reduce echoing.

In 2006, the City Hall building earned the coveted United States Green Building Council's Gold LEED Certification for its sustainable design qualities. The project obtained the gold status by meeting several different LEED green building guidelines, including its use of recycled and pre- and post-consumer materials such as copper in the building's construction.

"I am delighted that Austin City Hall, the community's cornerstone of democracy and civic involvement, has received this great recognition," stated Mayor Will Wynn. "Sustainability is a civic virtue that the city strives for in many different areas. It reflects our success, which is something that all Austinites can take pride in achieving." **HP**



Exterior and interior uses of copper helped Austin City Hall earn USGBC's Gold LEED certification.