cells, the cost of PV power remains high—and continues to rise due to a worldwide shortage of cell-grade silicon. This is where CIGS offers an important advantage. Compared to silicon, which requires multiple manufacturing steps before the material is shaped into individual cell wafers, the CIGS process is relatively energy-efficient, and its technology has advanced to a point where the material can now be deposited as a "coating" on inexpensive strips of material.

According to Scott Albright, director of Advance Programs for Global Solar, located in Tucson, Arizona, CIGS is now cost-competitive with silicon. "And," he adds, "unit costs will continue to decrease as we begin to take advantage of economies of scale." Like other CIGS producers, Global Solar is currently expanding its facilities to increase output—the factory here that produced the equivalent of four megawatts (MW/y) of solar units per year will churn out more than 40 MW/y in 2008. The company, which is owned in part by German solar module

many electronic devices employed by today's high-tech troops. The company has also created a line of innovative solar products used by outdoor enthusiasts and scientific researchers worldwide.

Also in development are rigid, panel-mounted modules suitable for commercial solar farms and home installations. Utilities foresee numerous small solar installations that can be located where energy is needed, as a way to more efficiently distribute electrical power. "That technology is coming," says Albright, "and that's where we believe a really significant amount of solar utilization will develop."

WHY IS COPPER IMPORTANT?

The CIGS material in a solar cell is only a few microns thick, and the copper in it makes up only a fraction of its
it is critical to the performance
Also, when distributed solar p
the scale Albright envisions, it

http://www.copper.org/innovations/2007/05/solar_energy.html)

This is not a staged picture! A scientist working in Antarctica needed an environmentally nonintrusive power source to recharge his PDA and lalptop batteries.

CORRECTION !!!!
Only the brackets are cast in Mexico,, the rest is made in the U.S., most of it in the shop in San Marcos CA and the shingles in Providence, R.I.

A 21st Century Coppersmith

Hans Liebscher remembers walking with his father through the cities of post-war Germany in the early 1950s and seeing the destruction to the homes and buildings lining the streets.

"Some of the buildings were burned out, and only their shells were standing," Liebscher recalls. "But for a lot of them, the copper roofs were still there. They were bright green. Some buildings even had copper still intact on the bay windows. It was really quite fascinating."

His appreciation for copper eventually grew into a vocation. At age 16, he became an apprentice in the metalsmith trade in his native country and later traveled throughout Europe to hone his skills and learn from other craftsmen.

Today, Liebscher is well-known in the copper industry in America, providing custom designed, handcrafted copper products and as an installer of copper building materials for the high-end residential market throughout the United States. Not long after relocating here from Germany in 1985, he opened a studio, Hans Liebscher Custom Copper Works and Sheet Metal, in San Marcos, California. Most of his signature copper work is done at his own foundry in Mexico. He works with several suppliers of copper in the USA. as well as in Europe.

The homes Liebscher has worked on are showcases for his talent, containing such unique copper features as hand-hammered bathtubs and sinks, standing seam window bays, chimney shrouds and hand-embellished fireplaces, ornate cupolas and

Continued on page 3

"Copper Roofs" Continued from page 1

Because it can take years for copper to achieve a green patina—a natural barrier that protects the metal and contributes to its legendary lifespan—the new building's roof will be prepatinated before installation, a process that accelerates the color change. This will allow the structure to more quickly blend into its surroundings.

Copper is visible on most of the roofs across the Dartmouth campus. Originally, slate was predominantly used, but the university gradually transitioned to copper through building additions and renovations. "Copper just seems to fit well with our architecture," explains Jack Wilson, Associate Director of Planning.

Wilson is responsible for selecting architectural materials for Dartmouth. While the college does not have specific architectural guidelines, he feels the campus buildings in general adhere to two existing, predominant styles: neoclassical and neo-Georgian. "You'll find copper on all the pitched roofs on campus," he says. "It really sets the tone."

Within its exterior of copper and brick, the new Life Sciences Center will house an array of laboratories and specialty classrooms that support Dartmouth's commitment to biological research. Included in the structure are features such as a 200-seat auditorium, two-story atrium, 30 "wet" labs, six teaching labs, two 80-seat amphitheatre classrooms and a 6,000 square-foot greenhouse.

Appropriate to its mission, the Life Sciences Center will be environmentally friendly. The building is expected to consume only half of the energy typically required to operate similar laboratories currently in use in the United States. State-of-the-art energy management and stormwater management systems are key features included in the design.

The project is estimated to cost $93 million when it is completed. The class of '78 is planning to tour their newly named building sometime around March 2010, the proposed opening date.

"The class of '78 is not only extraordinarily generous, but farsighted in enabling the work of students and faculty in critical fields such as life sciences," says Dartmouth president James Wright. "I'm excited by the prospect of having a building that not only is on the (architectural) cutting-edge for the space it provides, but will also be a national model of sustainable design." Cu

Elevation drawings of the new Class of 1978 Life Sciences Center building.

"Coppersmith" Continued from page 2

dormers, smooth-drawn copper door caps, ornamental fluted downspouts and gutter brackets, gargoyles and copper roof shingles and tiles.

The projects don't end there. He's quick to boast that, "if a customer can imagine it, I can create it."

"All of my intricate projects I do myself," Liebscher says. "It's very hard to find qualified help. And I've got some trade secrets that I don't want to give away."

Liebscher will either install a manufactured product for a builder or homeowner or make it entirely to specification. The more elaborate handcrafted copper installations can be pricey. An ornamental gutter system alone can cost well over a million dollars on a high-end custom home, he says, adding, "There's really no limit."

Currently, he's working on three very intricate copper projects for luxury homes in Las Vegas. The work includes ornamental copper gutters and downspouts, radius turret roofs and hand-hammered finials, hand-hammered columns, a handcrafted designer range hood for an outdoor pizza oven and a fireplace hood.

"What people are looking for, most of the time, is the more classical design," Liebscher says. "They want to recreate the look of buildings from 150 years ago."

Continued on page 4

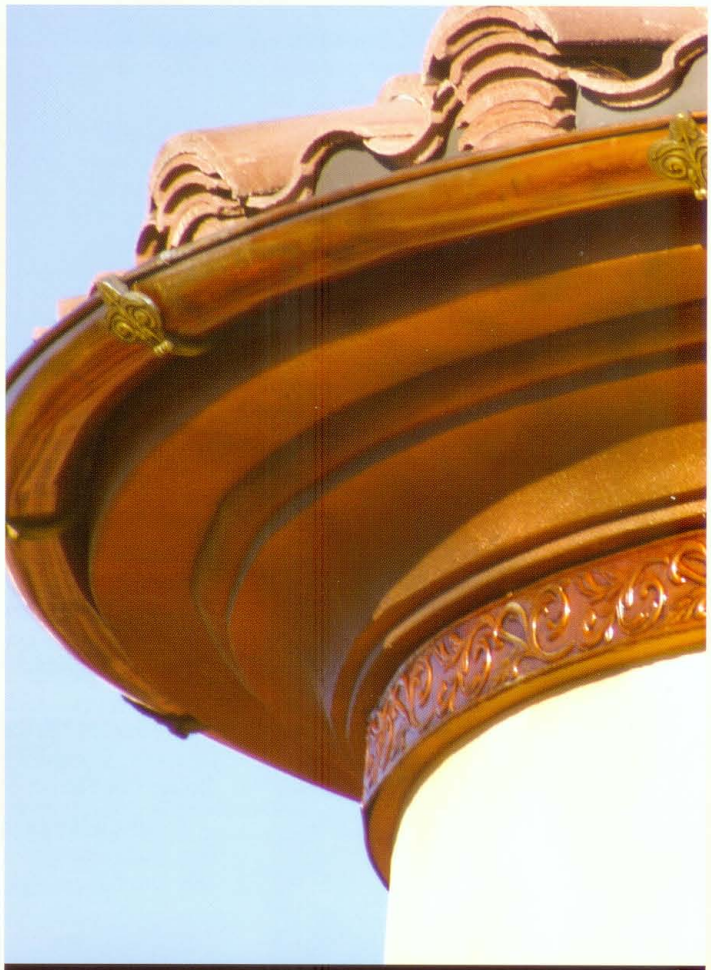

Photo of a copper frieze and curved gutter on Las Vegas home. (Photo courtesy of Hans Liebscher)

Diet and Depression

Are you always down in the dumps? Do you feel dejected even when things are going your way? You may suffer from depression—but the culprit may not be your job or your love life. It could be your diet.

Nutrient imbalances can play tricks with the mind and lead to irritability, anger, stress, memory loss and depression, according to the Health Research Institute and Pfeiffer Treatment Center. Two key nutrients that are important in controlling these feelings are zinc and copper.

Zinc is a building block for more than 80 enzymes that directly affect brain activity. Copper, however, works differently. It helps to convert dopamine, a chemical produced by the body and used in brain function, into norepinephrine, which is associated with heightened alertness and mood elevation. The results of this conversion can be pleasant—but too much can lead to overstimulation, hyperactivity and depression.

This problem may be harder for women to control because estrogen, a female hormone, increases the body's absorption of copper. Several studies have focused on nutrient imbalances and their link to post-partum depression, as well to general depression in both men and women.

These studies typically use blood copper as an indicator of copper status, and elevated blood copper is interpreted to be an indication of an elevated "copper load" in the body. However, high levels of copper in blood are completely independent of the copper level in the body. Copper has often been implicated in certain pathologic conditions, including post-partum depression, based upon the incorrect assumption that the amount of copper in your blood indicates the amount of copper in your body. In fact, copper in your blood is a good indicator of an active immune defense.

For example, when you have a flu or cold, the level of copper in your blood will triple, although—on the whole—you have no more or no less copper in your body. Therefore, be cautious when you consider making a correlation between elevated levels of copper in your blood and elevated levels of copper in your body. The science many times tells us otherwise.

The best way to ensure proper nutrition and a healthy body is to maintain a balance of copper and zinc in your diet. Keep in mind that too much zinc inhibits the body's ability to absorb copper. According to the National Academy of Sciences, a proper daily balance for adults is: copper, 0.9 mg (male and female); and zinc, 11 mg (males), 8mg (females). Cu

"Coppersmith" Continued from page 3

Photo of a designer hood ornament for an outdoor pizza oven being built for a Las Vegas. home. (Photo courtesy of Hans Liebscher)

In the desert where there is little humidity, copper products weather to a brownish, nut-like color, rather than the blue-green color associated with moist environments. Regardless, they maintain an equilibrium with nature and remain well preserved, an attribute that helps justify their premium value, Liebscher notes. "If copper is installed right, it's essentially maintenance-free and will last for hundreds of years. It doesn't need to be painted and it ages gracefully. It doesn't disintegrate with age, but becomes more prestigious, more beautiful."

Over the years, Liebscher has worked on historic renovation projects in Berlin, helped restore the Griffith Observatory in Los Angeles and was instrumental in saving or replacing copper aspects of other landmark buildings such as the Cotton Exchange, which was damaged by Hurricane Katrina in New Orleans.

"Copper is one of the oldest existing materials, and it has always had a good reputation," Liebscher says. "In some ways, copper has the same value as gold, because it was only found in prestigious and luxury buildings and lasted for centuries." Cu

RESOURCES

This edition of Discover Copper is also available online at www.copper.org and at www.homeplanningnews.com. For more information on the topics mentioned in this newsletter go to:

Global Solar Energy – www.globalsolar.com
Solar Forecast newsletter – www.solarforecast.com
Dartmouth College – www.dartmouth.edu
Hans Liebscher Custom Copper Works and Sheet Metal – www.hanscopper.com
Health Research Institute – www.hriptc.org