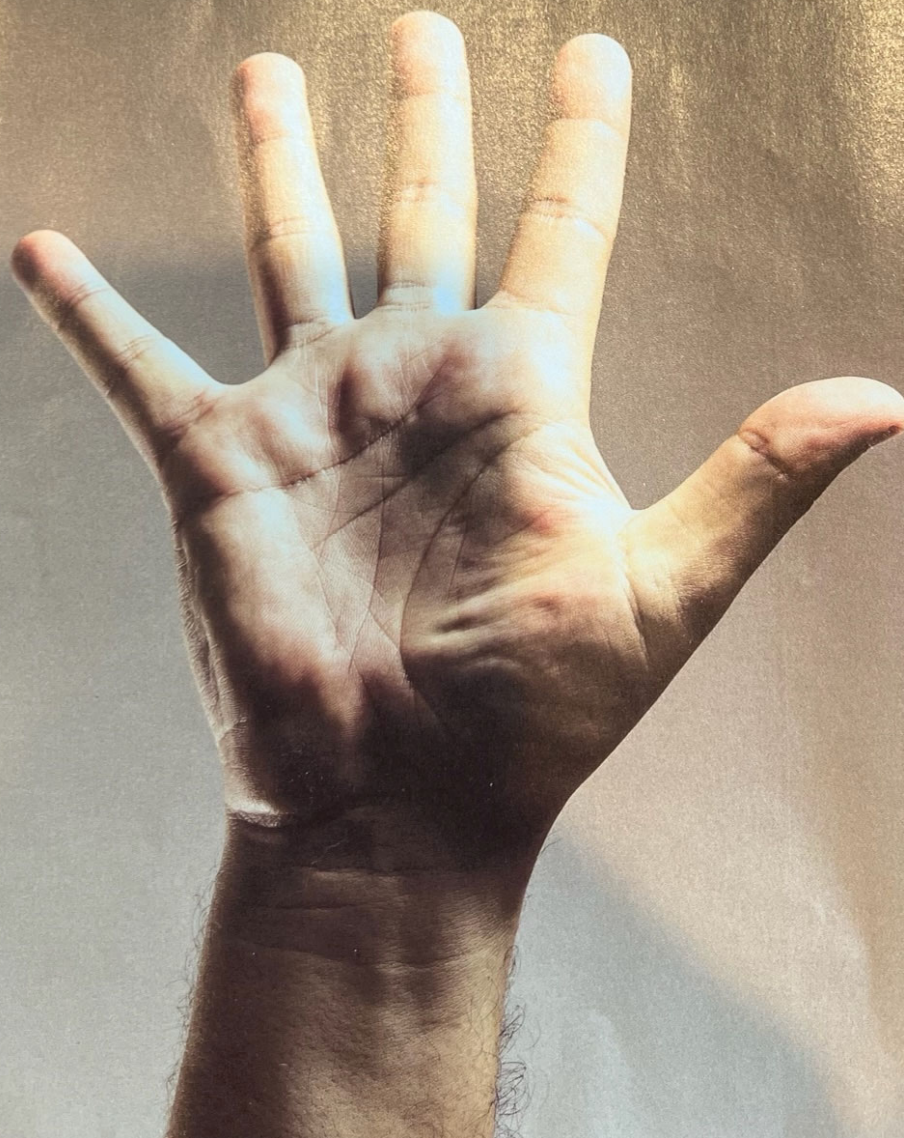


WHO'S READY FOR A COPPER-COVERED WORLD?

Invigorated by new EPA approvals about copper's COVID-killing and broad antimicrobial properties, experts urge the spread of copper products to halt the spread of illness. **KIM PHELAN, CONTRIBUTING EDITOR**



If West Point's ex-director of instruction for physical education should one day be talking to you about antimicrobial copper, one of his favorite subjects, businessman Tom Grace will hold up his hand toward you and say, "This is one of the most dangerous instruments known to mankind." He'll go on to explain the sordid legions of germs transmitted by human hands, which is why he's so passionate about copper's naturally-occurring, germ-decimating properties.

"It never calls in sick, it shows up for work 24/7 and never quits," he said. "It's a low-tech, very cost-effective solution where you only pay the delta one time."

It took years for him to be able to speak so frankly about copper, at least as it pertains to his own product line. Grace, whose high-end fitness supply-house, Black Iron Strength, has served many college and professional athletic teams since its inception in 1992, was one of many businesses that seized marketplace opportunity after the U.S. EPA first registered copper as a bacteria-killing surface material in 2008.

That was the last major EPA decision on copper's antimicrobial properties for the next 12 years—then COVID-19 showed up.

Suddenly, decades of research on copper's antimicrobial heroics compiled by McLean, Virginia-based Copper Development Association (CDA)—and a good many other studies, including a pair of eye-openers from the CDC and the NIH—hard-shifted EPA into an abrupt fifth gear. So much so that on February 10, 2021, the regulator announced it was registering alloys containing at least 95% copper as having the ability to kill viruses, something copper experts never doubted.

"New efficacy testing supported by the Copper Development Association and conducted according to EPA's protocols demonstrated certain high-percentage copper alloy products can continuously kill viruses that come into contact with them," stated the EPA press release. "Based on testing against harder-to-kill viruses, EPA expects these products to eliminate 99.9% of SARS-CoV-2, the virus that causes

COVID-19, within two hours."

It was a watershed moment for copper, according to CDA Director of Rod and Bar Adam Estelle, a copper authority who has been collaborating with the EPA for over a decade. Overnight, OEMs across every industry up and down the supply chain were at liberty to assert the EPA-approved virus- and bacteria-killing claims of copper on their product labels, as long as they sourced EPA-registered copper alloy compositions from EPA-registered suppliers. And while no one anticipated or remotely desired the global pandemic, it was indeed an inflection point for copper to potentially star in a host of applications well beyond hospitals, encompassing repetitively-touched surfaces in schools, restrooms everywhere, restaurants, hotels, food processing factories, mass transit, airports, laboratories, cinemas, retail and office environments, fitness, HVAC, and more.

"It certainly stimulated a lot of activity and innovation in the supply chain as more and more companies became curious about these materials and were trying to figure out how they



Hospitals—not to mention restrooms everywhere—are just the beginning for applications where copper surfaces can play a pivotal role in killing bacteria and viruses 24/7.

might be able to incorporate copper surfaces into some of their products,” said Estelle.

Lawmakers Take Note

EPA’s action caught the attention of some lawmakers, too. Less than a month following the move, Congressmen Brian Higgins (D-NY) and Robert Latta (R-OH), co-chairs of the Copper Caucus, invited their peers to join them in bilateral support of the copper industry, in view of its new virucidal public health claims.

“With over 40,000 employees in 30 states and 100 Congressional Districts, the domestic copper industry is a key national driver contributing mightily to the economic success of the United States,” they wrote to fellow members of Congress. “Beyond its antimicrobial properties, copper, the world’s oldest metal, is also one of the most versatile. Copper products are 100% recyclable and ... are key contributors in renewables and energy efficiency, and both electric vehicles and their charging stations are powered by copper.

“This bipartisan caucus seeks to work together to advance policy positions and legislation which would be helpful to the domestic copper industry and to support the Members’ and



EPA’s 2021 action freed manufacturers in a host of industries to bring high-touch products to market and legally make agency-specified, germ-killing claims.

the public’s awareness of the benefits of copper and copper alloys in their daily life.”

Meanwhile, for the year ahead, the CDA will continue to collaborate closely with the EPA to conduct confirmatory testing on the virus-killing properties of copper alloys with lower copper content. “Securing virucidal claims for additional copper alloy compositions would give manufacturers even more solutions to work with that span a wide range of colors and engineering properties,” said Estelle.

“We are optimistic that we’ll see some progress hopefully this year,” he added. “The immediate goals are getting through the EPA process ... it’s really

about just removing barriers to our members’ supply chains and clearing the way for industry to talk about this [antimicrobial] property in a responsible and scientifically accurate way.”

A COVID Disclaimer

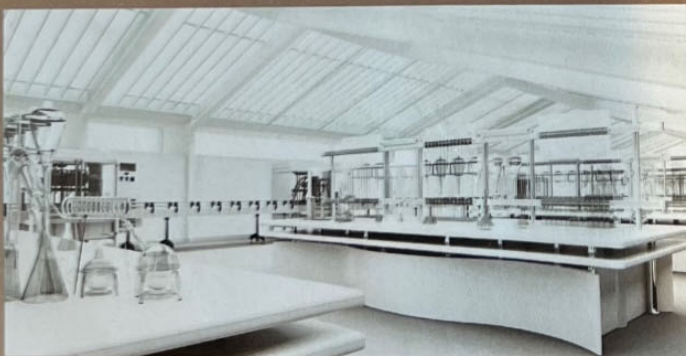
The official conclusion that copper surfaces kill the virus causing COVID was certainly cause for exuberance, and no one could be more pleased than Estelle, who said working with the EPA has been mutually gratifying. However, he is quick to remind that surface transmission is not the primary route through which COVID is spread—rather, people are chiefly infected by breathing airborne droplets.

“We’re very cautious about the messages we put out concerning any cause and effects specifically for COVID,” he said. “I wouldn’t say the risk is zero for picking up COVID from a contaminated surface, but we always make sure that we’re not positioning copper as some sort of silver bullet for this particular virus that’s primarily transmitted through the air.”

Rather, CDA positions copper as supplemental to and not a substitute for hygienic and disinfectant practices such as hand-washing and cleaning surfaces. “The best thing about it,” he said, “is that it’s truly independent from human behavior.”

COVID has perhaps been a wake-up call, Estelle added. Advancing copper’s virus-killing efficacy now—and establishing antimicrobial copper products more widely in public places—could set society up for a stronger defense should future pandemics be highly transmissible through surfaces.

HERE’S YOUR PROOF



The Copper Development Association has built an accessible digital library of papers, studies, and various other resources it has accumulated over the years while providing bodies of evidence to the U.S. Environmental Protection Agency. Want to read the science behind copper’s antimicrobial efficacy? Have at it right here:

<https://www.antimicrobialcopper.org/evidence-and-studies>. MC

Despite known transmission realities, chemical cleaning of highly-touched surfaces has saturated a COVID-fearing world. Grace cited data showing most people have been exposed to 400% more harmful chemicals since the start of COVID in early 2020 from “all the incessant cleaning,” he said. “I don’t know why there isn’t more out there on antimicrobial copper.”

Marketplace Snapshot

Grace first read about copper’s germ-killing properties in 2009 and became so zealous about its potential health and safety advantages in the fitness industry that he spent four years of R&D—and considerable consultation with the CDA—to engineer a process for incorporating a solid copper alloy into the knurled handle grips of his company’s free weights. His first customer for copper products was the U.S. Olympic Committee, which was outfitting a new training center in Colorado Springs.

But the sales of copper-containing products haven’t exactly brought Brinks trucks rolling to and from his doors, said Grace. While Black Iron Strength’s copper orders went from 40% pre-COVID to 90% today, and both college and professional sports teams have been early adopters—with high stakes in the health of their star athletes—Grace has nonetheless been dismayed by an underwhelming public response thus far. He attributes lackluster investment in copper products by gyms and other industries to the financial devastation wreaked by year-long,



Black Iron Strength has incorporated copper into the grips on free weights, and owner Tom Grace is confident copper’s public-health value will catch on in his industry once gyms recover from pandemic-related hardships.

nationwide shuttering of businesses.

But he believes patience will prevail.

“I’m a privately-held company, and I have a long-term vision,” he said. “I’m all in. I see the big picture, and I know this is going to grab on once things start getting back to some new type of normal. I’m very patiently waiting for that.”

His optimism springs from positive persuasion that copper has no down side. With a negligible 10% cost premium on average and EPA’s science-backed stamp of approval, Grace said he’s confident copper adoption in the fitness world will indeed trickle down from pro and college sports to mainstream workouts. As for OEMs at large, he believes now is the time for companies to envision their own possibilities with copper.

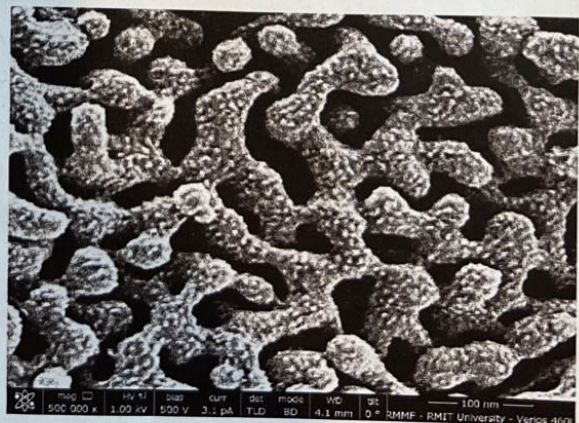
“What are the negatives? There really aren’t any,” he said. “OEMs have the opportunity to provide whatever product

they make using antimicrobial copper, which, now more than ever, the world desperately needs.”

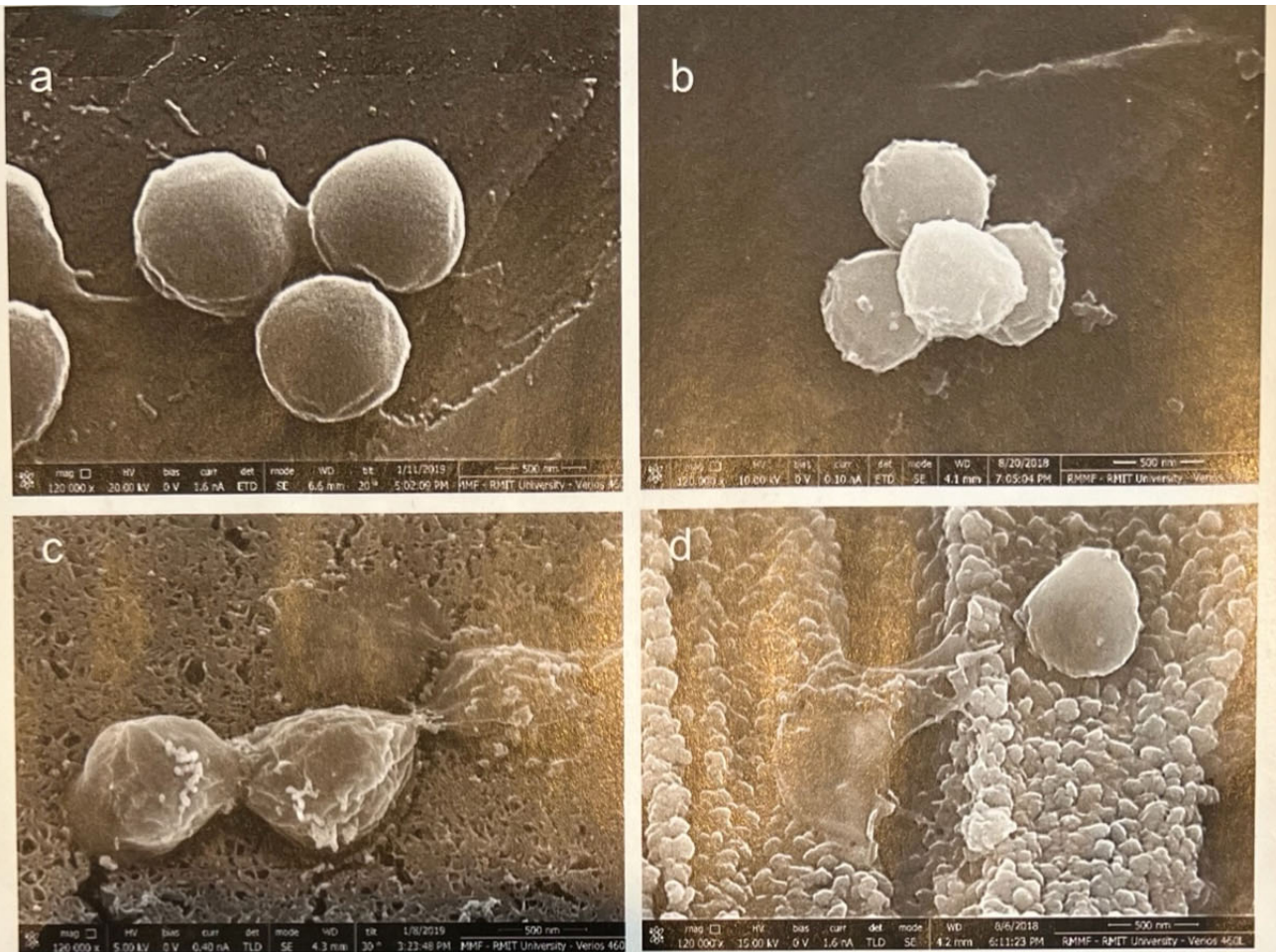
International Snapshot

The world of academia continues to join with industry in the pursuit of more understanding about copper and developing more ways to harness its protective activity. On December 13, RMIT University in Melbourne, Australia, announced it had developed a new process for creating copper surfaces in castings whereby bacteria—and antibiotic-resistant superbugs—are killed 100 times faster than standard copper. The university, together with Australia’s national science agency, CSIRO, published its findings in “Biomaterials.” (<https://bit.ly/RMIT-copper>)

“A standard copper surface will kill about 97% of golden staph within four hours,” said RMIT Distinguished Pro-



Shown at 200,000 (left) and 500,000 (right) magnification, the post-dealloyed, comb-like copper surface enables release of germ-killing copper ions much faster—just two minutes, according to RMIT’s research.



Images magnified 120,000 times under a scanning electron microscope show golden staph bacteria cells after two minutes on (a) polished stainless steel, (b) polished copper, and in (c) and (d), the team's micro-nano copper surface. Note the mechanical stretching of the bacteria cells caused by the new copper surface's super-hydrophilic property that weakens the germ.

fessor Ma Qian, who began his career in metalcasting. “Incredibly, when we placed golden staph bacteria on our specially-designed copper surface, it destroyed more than 99.99% of the cells in just two minutes.”

According to RMIT's press statement, the release of copper's ions— toxic to bacterial cells as well as virus cells, per the U.S. EPA—is a slow process and researchers worldwide are racing to discover how to speed it up.

Qian and Ph.D. candidate Jackson Leigh Smith, the lead study author, used a cheap and scalable dealloying process that causes copper atoms to reorganize themselves. First, they developed their own version of a copper-manganese alloy, at a 40–60 atomic ratio respectively. Dealloying was as simple as immersing as-cast products from the alloy in near-room temperature hydrochloric acid (60C) for about two hours. What happened next could only be witnessed through the lens of 200,000-X and 500,000-X magnification instruments.

The manganese atoms are 99%–100% removed, leaving only pure copper atoms that are transformed into a porous, comb-like, and dendritic micro-nano-microstructure that enables copper ions to more rapidly release to the surface and destroy germs. The reconfigured copper surfaces are also super-hydrophilic, said Qian, creating a water-loving interface that causes bacterial cells to be stretched out, deformed, and thus more vulnerable to the attacking copper ions.

Another beneficial outcome stems from RMIT's dealloying process.

“The total internal surface area of each gram of this new material is 11 square meters,” Qian said. “That's massive.”

Fast-firing copper ions, weakened bacteria (due to mechanical stretching) readily absorbing enemy toxins, all enhanced by expanded contact area between bacteria and the copper surface is getting the job done with unprecedented velocity, as Qian's small team has shown. RMIT's next phase

will be finding casting/manufacturing partners to create real parts, which will enable further testing of the new material both in the laboratory and in population-dense environments such as train stations and movie theaters. Among the issues to be investigated is whether dealloyed copper castings retain their potency against germs after surface oxidization (corrosion) occurs, but scientific papers have already documented copper oxide is effective, said Qian.

Because copper kills harmful microbes continuously and seems unfettered by metalcasting as well as metal forming and fabricating processes, the sky's the limit on how humans will apply the germ-shield gifted from nature.

“We're going to continue to see all sorts of different ways that we can capitalize on this property of copper,” said Estelle at the CDA, “and we're working to make sure we get more and more options out there to do that.” **MC**