

MATERIALS SCIENCE AND CORONAVIRUS SERIES

EPA OFFICIALLY SAYS COPPER SURFACES HELP FIGHT COVID-19

The story behind the Environmental Protection Agency's registration of copper surfaces against the virus that causes COVID-19.

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In May 2020, a short article^[1] describing why copper has the potential to help in the fight against COVID-19 was published in *Advanced Materials & Processes* magazine. The article cites a short pioneering study^[2] illustrating that SARS-CoV-2, the virus that causes COVID-19, was inactivated in 4 hours on 99.9% copper surfaces, but remained infective for a prolonged period on plastic and 304 stainless steel.

The *AM&P* article also discussed a 2015 publication^[3] on another human coronavirus (Hu-CoV-229E) that also causes lung disorders. Six copper alloys, ranging from 100% to 60% Cu, balance Zn, as well as a series of copper nickel alloys were challenged by Hu-CoV-229E. Rapid inactivation of Hu-CoV-229E was observed on different copper alloy surfaces within 10 minutes.

Although these two articles^[2,3] used different strains of human coronavirus, both viruses are essentially structurally identical. They display the now familiar spherical shapes, but with slight differences in their spike proteins. It was surmised that both of these coronaviruses would be inactivated by copper by the same mechanism of attack because of their similar structures.

A more recent paper^[4], published on January 2, 2021, showed that the COVID-19 causing virus, SARS-CoV-2, was inactivated by copper in as little as 1 minute. This paper confirms the speculation made in the *AM&P* article^[1] that

because copper was effective against Hu-CoV-229E, it would also be effective against SARS-CoV-2. Copper is effective against both of these human coronaviruses because they have very similar structures. All of this information was made available to the U.S. Environmental Protection Agency (EPA).

EPA ANNOUNCEMENT

On February 10, 2021, the EPA announced that it has registered certain copper alloys that have demonstrated effectiveness against viruses, including SARS-CoV-2, the virus that causes COVID-19^[5]. (See "EPA Registers Copper Surfaces for Residual Use Against Coronavirus.") Note that this is the first antimicrobial product that is registered for "residual" use against viruses. Traditional disinfectants only kill viruses and bacteria on the surface at the time they are used, while in contrast, "residual" antimicrobial disinfectants kill pathogens that come in contact with the surface days, weeks, or years after the product is applied. This residual antimicrobial property of copper alloy surfaces provides a unique advantage in the fight against COVID-19 infections.

FUTURE PANDEMICS

The EPA acted very quickly because of the seriousness of the COVID-19 crisis. Thus copper alloy surfaces can now be used in the fight against SARS-CoV-2 as well as other pandemic viruses

AM&P'S MATERIALS SCIENCE AND THE CORONAVIRUS SERIES

This article is the eighth installment in an *AM&P* series on materials science and coronavirus. Below is a list of the first seven articles:

- Can Copper Help Fight COVID-19? May/June 2020.
- Copper's Conductivity and Antimicrobial Properties Inspire Renewed Interest, July/August 2020.
- Antimicrobial Copper-Containing Stainless Steels Show Promise, September 2020.
- Using Digitally Distributed Manufacturing to Address Critical Needs, October 2020.
- Development and Validation of High-Performance SARS-CoV-2 Antiviral Coatings for High-Touch Surfaces, November/December 2020.
- Supersonically Deposited Antiviral Copper Coatings, January 2021.
- Optimizing 3D-Printed, Reusable Metal N95 Filters by 3D Characterization and Modeling, February/March 2021.

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that may emerge in the future. A variety of new viral infections seems to rapidly spread around the world, perhaps because of the ease of air travel. Thus it seems logical to deploy copper touch surfaces as a first line of defense in transportation facilities, including airports, train and bus stations, as well as planes, rail cars, and buses. Of course, nursing homes, extended care facilities, and hospitals should also be outfitted with copper alloys because they house a very susceptible demographic.

~AM&P

Lead image: 2019-nCoV spike protein, courtesy of Jason McLellan/University of Texas at Austin.

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References

1. H.T. Michels and C.A. Michels, Can Copper Help Fight COVID-19?, *Advanced Materials & Processes*, Vol 178, No. 4, p 21-24, 2020.
2. N. van Doremalen, et al., Aerosol and Surface Stability of SARSCoV-2 as Compared with SARS-CoV-1, *N. Engl. Jour. Med.*, 2020, DOI: 10.1056/NEJMc2004973.
3. S.L. Warnes, Z.R. Little, and C.W.

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4. C. Bryant, S.A. Wilks, and C.W. Keevil, Rapid Inactivation of SARS-CoV-2 on Copper Touch Surfaces Determined Using a Cell Culture Infectivity Assay, *bioRxiv*, DOI: 10.1101/2021.01.02.424974.

5. EPA Registers Copper Surfaces for Residual Use Against Coronavirus, February 10, 2021, [epa.gov/newsreleases/epa-registers-copper-surfaces-residual-use-against-coronavirus](https://www.epa.gov/newsreleases/epa-registers-copper-surfaces-residual-use-against-coronavirus).

EPA REGISTERS COPPER SURFACES FOR RESIDUAL USE AGAINST CORONAVIRUS

The U.S. Environmental Protection Agency (EPA) announced that certain copper alloys provide long-term effectiveness against viruses, including SARS-CoV-2, the virus that causes COVID-19. As a result of EPA's approval, products containing these copper alloys can now be sold and distributed with claims that they kill certain viruses that come into contact with them. This is the first product with residual claims against viruses to be registered for use nationwide. Testing to demonstrate this effectiveness was conducted on harder-to-kill viruses.

In this action, EPA is granting an amended registration to the Copper Development Association for an emerging viral pathogen claim to be added to the label of Antimicrobial Copper Alloys- Group 1 (EPA Reg. No. 82012-1), which is made of at least 95.6% copper. Amended registrations allow previously registered products to make label changes (e.g., changes to product claims, precautions and/or use directions) and/or formulation changes. In this case, the amended registration is adding virus claims to the product registration.

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. 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.

Antimicrobial copper alloys can be manufactured into a wide range of surfaces, including doorknobs and handrails. These high-percentage copper alloy products will be added to the List N Appendix, the Agency's list of residual antiviral products that can be used to supplement routine cleaning and disinfection to combat SARS-CoV-2.

