Antimicrobial coating for fingerprint scanners

INTRODUCTION

Similar to any other surface that people touch with their hands or fingers, fingerprint scanners are a potential source for the transmission of bacteria and viruses from one person to another. Although regular disinfection reduces the risk of infection, antimicrobial coatings can offer additional security by adding a permanent solution to effectively kill microorganisms.

REDUCING RISK OF INFECTION WHEN USING FINGERPRINT SCANNERS

Depending on the material, bacteria and viruses can survive on surfaces between a few hours and several days. Regular disinfection of the contact surfaces helps to reduce the risk of infection effectively[1]. However, it requires a careful regimen of disinfection and a continuous availability of cleaning supplies. In order to minimize the infection risk even more, a self-sterilizing approach has been developed that is applicable to all JENETRIC fingerprint scanners.

ANTIMICROBIAL COATING

Besides disinfecting agents, there are various ways to disinfect and sterilize surfaces, such as with UV radiation or ozone treatment. These measures require additional equipment, trained personnel, and cause downtime when the fingerprint scanner cannot be used. Antimicrobial coatings have been available for many years and have been proven to inactivate microorganisms effectively. Furthermore, they do not require any additional equipment or consumables to be used.

When applying an antimicrobial coating to fingerprint scanners, various parameters need to be considered:

- Effective against bacteria and viruses
- Nontoxic and non-sensitizing to human skin
- No loss in fingerprint quality
- Durable and robust against abrasion and cleaning
- Harmless to the materials of the fingerprint scanner

COPPER AS AN ANTIMICROBIAL AGENT

Used as water lines, on roofs and as an antifouling component in paints, copper's antimicrobial properties have been well known for decades. In hospitals, copper alloys are already used to reduce the risk of infections on handrails, doorknobs and bed rails.

When microorganisms come into contact with copper there are several mechanisms that kill them: disruption of the cell wall, oxidative stress to cells, and interaction with the proteins that keep the microorganism alive. As a result, the bacterial or viral genome is fragmented thus ensuring that the inactivation is irreversible.

Copper has been proven to kill microorganisms such as MRSA, E. coli, Influenza A and Norovirus[2]. In a study published by Warnes et al. it has been shown that copper alloys also kill enve-

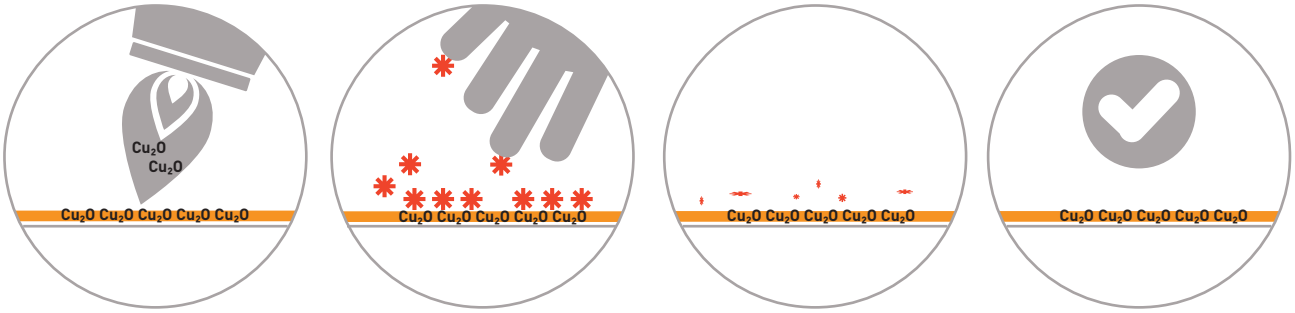
[1] https://www.jenetric.com/fileadmin/user_upload/Downloads/Disinfection_LIVETOUCH_scanners_JENETRIC_Stand_05_20.pdf
[2] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4561453/

loped viruses, such as the human coronavirus 229E (HuCov-229E), one of the seven corona viruses, successfully[3]. The authors observed rapid damage, including clumping, breakage, membrane damage, and loss of surface spikes to the coronavirus particles following exposure to copper. Depending on the copper alloy and the percentage of copper, the first damage to HuCoV-229E was observed within minutes after coming into contact with copper. In a very recent study van Doremalen et al. showed that SARS-CoV-2 virus survives on surfaces from 4 hours (copper) to several days (plastic)[4].

HOW DOES THE ANTIMICROBIAL COATING WORK?

The antimicrobial coating is applied by using Combustion Chemical Vapor Deposition (CCVD) at atmospheric pressure. This process enables a gas phase reaction of inorganic particles. Copper(I) -oxide (or cupric oxide) is used as the antimicrobial agent. During the vaporization pro-cess the antimicrobial coating composition is applied to the fingerprint scanner. After several passes, the optimal coating thickness is achieved.

Copper(I) oxide is officially listed as biocidal agent in the European Biocidal Directive 98/8/EC[5].



Antimicrobial Coating

Scanner surface is equipted with a permanent antimicrobial coating.

Deposition

Viruses, germs and spores are transferred to the coated surface by hand contact.

Killing of bacteria and viruses

Microrganisms are killed by cupric oxide.

Decontamination

The scanner surface is disinfected.

FINGERPRINT QUALITY AND ROBUSTNESS OF THE COATING

Careful investigation of the fingerprint quality for FBI Appendix F image quality parameters, NFIQ 2.0 quality checks, and visual assessment did not show any impact on the fingerprint quality due to the antimicrobial coating.

In order to simulate the real-life use of the coated fingerprint scanner, both washability and severe abrasion were tested. Washability (the resistance against cleaning agents) was tested by using brushes and a wet environment according to ASTM D4213-92/D4828 and severe abrasion was tested in accordance with ISO 1518-1 with a scratch resistance testing device RH3 (Coesfeld GmbH & Co. KG) using steel wool as a load body and an additional load of 1000 g.

[3] https://mbio.asm.org/content/6/6/e01697-15
[4] https://www.nejm.org/doi/pdf/10.1056/NEJMc2004973?articleTools=true
[5] https://circabc.europa.eu/sd/a/55fd1c62-5e4e-43e4-a99b-76aa51d07c57/Copper%20II%20oxide%20(assessment%20report%20as%20finalised%20on%2022.09.11).pdf

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After these tests, a sufficient film thickness of the antimicrobial coating was verified, and biological tests proved the lack of microbial activity. This shows that the antimicrobial coating can withstand even a harsh environment.

SUMMARY

Antimicrobial coatings reduce the risk of infection significantly. Our coating approach and the use of copper as an antimicrobial agent are proven measures that not only kill bacteria and viruses but also do not impact the fingerprint quality, harm human skin, or damage the fingerprint scanner in any way.