"Antibacterial copper coatings for frequently touched and heat sensitive surfaces"

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Abstract:
The rapid pandemic spread of COVID-19 has created multiple health and socioeconomic challenges with potentially devastating unknown consequences. Current estimates are that the development of effective therapeutics to fight infection and propagation of COVID-19, such as anti-viral drugs and vaccines, are at least several months away. The global active infection cases on May 12, 2020 was 4.3 million people, with a mortality rate ranging from 5.9% (US) to 11.8% (Spain). The spread of COVID-19 is partly mediated by aerosol droplets from the nose and mouth onto surfaces which then transmit through touch. Copper, silver and zinc have for decades been demonstrated to have potent biocidal properties, irreversibly inactivating a wide range of viral pathogens, such as poliovirus, herpes simplex, and influenza. Importantly, copper inactivates COVID-19 within 4 hours (Shafaghi et al., 2017; https://melmagazine.com/en-us/story/copper-kills-covid-its-time-for-a-steampunk-renaissance). Irreversible inactivation is mediated by the fragmentation of viral coat proteins and genomes. Our team was the first to demonstrate that the high cost of manufacturing complex three-dimensional designs with copper surfaces can be circumvented using thermal spray technology to coat metal and heat-sensitive organic surfaces (e.g., polymer composites, wood) with copper alloys. The highly durable 100 μm-thick copper alloy coatings degraded bacteria within minutes and resilient bacterial spores within a couple of hours. Importantly, our studies also confirmed that the coatings micro-structure is far more effective in inactivating bacteria than solid metal surfaces. We believe that thermal spray technology can be immediately applied as a highly cost-effective process to irreversibly and continuously inactivate the spread of COVID-19 and multiple other pathogens in health care and other facilities.

Presenter Bio:
Dr. Javad Mostaghimi is a Professor in the Department of Mechanical & Industrial Engineering at the University of Toronto and the director of the Centre for Advanced Coating Technologies (CACT). He received his BSc degree from Sharif University, Iran, in 1974, and MSc and PhD degrees in Mechanical Engineering from the University of Minnesota, Minneapolis, in 1978 and 1982, respectively. Before joining the University of Toronto in 1990, he held positions at Pratt & Whitney Canada, Longueil, Quebec, and the Department of Chemical Engineering, University of Sherbrooke, Sherbrooke, Quebec.

His main research interests are the study of thermal spray coatings. He has performed comprehensive studies on the flow, temperature, and electromagnetic fields within arcs and RF inductively coupled plasmas. Professor Mostaghimi has done extensive simulation of the dynamics of droplet impact and solidification in thermal spray processes as well as design of novel DC and RF plasma torches.

Professor Mostaghimi is a fellow of the following professional societies: RSC, ASME, ASM, CSME, EIC, CAE, AAAS, IUPAC, and the Faculty of Engineering at the University of Tokyo. He is a recipient of the 75th Anniversary Medal of the ASME Heat Transfer Division, the recipient of the 2013 Robert W. Angus Medal of the CSME, 2012 Heat Transfer Memorial Award of the ASME, 2011 Jules Stachiewicz Medal of the CSME, 2010 NSERC Brockhouse Canada Prize and the 2009 Engineering Medal in R & D from the Professional Engineers of Ontario. In May 2019, Dr. Mostaghimi was inducted into the ASM Thermal Spray Hall of Fame.

He is a member of the editorial board of Plasma Chemistry and Plasma Processing and a member of the International Review Board of the Journal of Thermal Spray.