Job Description for Antiviral Coatings

Brief about the Startup:

EMSPL is aiming to develop devices and related applicability of new magnetic nanostructured materials specifically, multiple elements such as high entropy/multicomponent alloy nanowires/thin films comprising of five elements. These five-element nanostructures are novel materials has tremendous potential outcome in materials science (sensors/devices), biomedical (therapeutic agents) and metallurgical engineering (coatings).

Brief about Antiviral Coatings

Since the outbreak of COVID-19 disease in 2019 by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), researchers around the world have been working on various approaches to control the infection. However, in the current situation of a public health emergency from this novel virus and its associated outbreak, controlling the infection is possible only by preventing the spread. Prevention against this pandemic requires the understanding of the mechanism of transmission. Until the development and implementation of vaccination, which is being the primary prevention, respiratory protection and/or quarantine are the most effective ways of preventing the transmission. In this present scenario, this virus can be mainly spread by two modes of transmission such as through small (aerosol) and large droplets and physical contact with contaminated surface/person. However, since the severity, impact on population and duration of the pandemic cannot be accurately predicted, respiratory protection technologies are the only resorts by which infectious spread may be reduced. At this point, with the limited available resources, insufficient supplies, and time (quarantine/lockdown), **there is a need for, and development of reusable, respirators/masks with anti-viral properties on an urgent basis**. Nanotechnology approaches to develop these materials is a potential avenue in terms of fighting against the viruses and preventing the infection. Materials at the atomic scale with large surface area to volume ratios and with their crystallographic oriented facets, such as for metallic nanoparticles, are expected to increase the chemical activity thereby making them a promising anti-microbial nanomaterial to fight against the various pathogens like viruses, etc.

The current proposal aims to coat metal nanoparticles on non-woven activated carbon fibre to address the above mentioned three functionalities.

As the few metal nanocoating inactivates the viruses and can prolong the usage of the masks without needing for its further sanitization like washings of the masks. However, the main challenge is the leaching of nano-metallic particles during such mishandled washings which is not advisable. To overcome this, strong adhesion of the coated nanoparticles is very important. Therefore, **the present proposal focuses on coating of few beneficial metal nanoparticles by electrochemical reduction which not only enhances the adhesion of the nanoparticles on the carbon fibre cloth but also allows the mask for prolonged usages without leaching.** It can be fitted as an inner layer of the masks/cartridge, then it can lead to minimize or negligible leaching to the environment. These coated mask materials can be commercialized as reusable masks for a prolonged time without losing its integrity. Moreover, electrochemical reduction is a very cost-effective and scalable process with minimum requirements of chemicals, ability of full recovery of the metal ions from the leftover electrolyte and with minimum waste disposable cost. Also, it is very feasible to scale up from the lab demonstrated scale to manufacture products at an industrial scale. In addition, this is a very rapid and safe process unlike the existing chemical methods where,

the stabilization of nanoparticles in various chemicals takes several hours and the nanoparticles along with its chemicals used for its stabilization gets coated on to the masks while dipping/spraying of the nanoparticle suspension. This can reduce the efficiency and may not be recommended due to several safety issues where, there is a possibility of inhalation of the chemicals by the wearer.