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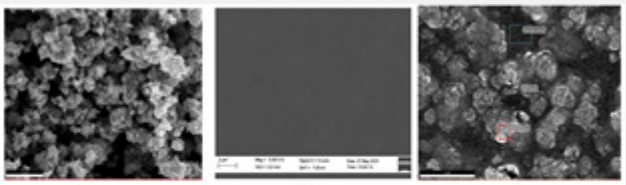
Development of self-disinfection TiO2 nanoparticles - Polymer coating on metal surface

Statement of the Problem: To prevent the transmission of COVID-19 many researchers propose oxide nanoparticles to disrupt coronavirus survival on solid surface. For example, when TiO2 nanoparticles interact with visible light, water and oxygen, hydroperoxyl, a free radicals, are releases that able to kill germs, bacteria, fungus and virus on their surfaces. We propose to add the nanoparticles in a medium so that the mixture can be painted or sprayed in a larger area of surface items. However, mechanical integrity of the coating and the effectiveness of the TiO2 nanoparticles within the medium in releasing the free radicals is scarcely reported. The aim of this work is to develop a novel self-disinfection coating which can be applied on metal surfaces to combat coronavirus. Methodology & Theoretical Orientation: TiO2 nanoparticles was added to poly(vinyl alcohol), PVA, which is a water-soluble polymer. The coating was evaluated for microstructure integrity and UV-light absorption properties. Findings: After drying of the raw materials solution, continuous coating of PVA-TiO2 nanoparticles was produced. Examination under SEM (Figure 1) shows that PVA coating has a smooth surface while TiO2 nanoparticles have a spherical like structure with some agglomeration. A contrast structure is observed which indicates the existence of TiO2 nanoparticles embedded in the PVA matrix. UV visible absorption spectrum of PVA-TiO2 composite coating shows energy absorption in range of 352-365.07 nm, in comparison to 320-380 nm of TiO2 nanoparticles. Conclusion & Significance: Continuous coating of PVA containing TiO2 nanoparticles with the absence of crack or pores has been developed. Dispersion and good bonding between TiO2 nanoparticles and the polymer is crucial factor in governing mechanical strength and durability. The coating exhibit UV-Vis energy absorption in values close to TiO2 nanoparticles which possess an optical band gap of 3.2 eV, suggesting a potential for antibacterial properties.



(a) (b) (c)

Figure 1: SEM morphology image for (a) TiO_2 nanoparticles and coatings of (b) pure PVA (c) nanoparticles-PVA mixture

Biography

Professor Dr. Zuhailawati Hussain is a professor in metallurgy from the School of Materials and Mineral Resources Engineering, Universiti Sains Malaysia. Her research work emphasizes on the development of novel and sustainable metal matrix alloys and composites using environmentally friendly manufacturing methods including powder metallurgy, surface engineering and welding. Professor Zuhailawati highlights selection, formulation, microstructure and fabrication of novel alloys and metal composites in creating new potential of advanced materials benefiting society. Her research on antiviral and antibacterial coating development is supported by Special Program For Research Against Covid-19 (SPRAC) provided by AUN/SEED-Net JICA (304.PBAHAN.6050455.A119). The self-disinfecting TiO2 nanoparticles with biodegradable polymer based coating are expected to combat COVID-19 transmission which could reduce the spreading and help people to relief their anxiety while touching contaminated surfaces in public places particularly metal objects.