COMPARISON OF TRIBOLOGICAL AND ANTI-MICROBIAL PROPERTIES OF CrN/Ag, ZrN/Ag, Sn/Ag, AND CrN/Cu NANOCOMPOSITE COATINGS

PJ Kelly[1*], H Li[1], KA Whitehead[1,2], J Verran[2], RD Arnell[3] and I Iordanova[4]

[1]*Surface Engineering Group, Dalton Research Institute, Manchester Metropolitan University, Manchester M1 5GD, UK*
[2]*School of Biology, Chemistry and Health Science, Manchester Metropolitan University, Manchester M1 5GD, UK*
[3]*Jost Institute of Tribotechnology, University of Central Lancashire, Preston PR1 2HE, UK*
[4]*Department of Solid State Physics and Microelectronics, Faculty of Physics, University of Sofia, Bulgaria*

ABSTRACT

Nanocomposite coatings including CrN/Ag, ZrN/Ag, TiN/Ag and CrN/Cu with varying silver or copper contents were produced by co-deposition in a dual pulsed magnetron sputtering system. The composition and structure of the coatings were characterised using energy dispersive X-ray spectroscopy (EDX), scanning electron microscopy (SEM) and X-ray diffraction (XRD), and the physical and tribological properties were assessed by means of nanoindentation, scratch adhesion testing and thrust washer wear testing. Although increasing silver content provided a reduction in the coefficient of friction, this was accompanied by reductions in hardness and wear resistance. Zones of inhibition were used to determine the extent of silver ion release from the coating surfaces, and a NBT (nitro-blue tetrazolium) redox dye was used to determine the anti-microbial effectiveness of the coatings when cells were inoculated directly onto the surface and left for a designated time period. Using an agar overlay method, cells remaining viable multiply to produce a visible colony. The microorganisms tested were *Pseudomonas aeruginosa, Escherichia coli* and *Staphylococcus aureus*.

For the NBT assays, significant reductions in the number of viable cells were observed with increasing Ag or Cu content, compared to the 'pure' nitride surfaces. Whilst no zones of inhibition were observed for *S. aureus*, on any of the surfaces, the diameter of the zones of inhibition generally increased with increasing silver content for the other microorganisms.

Thus there is some evidence of an antimicrobial effect by diffusion and also by direct contact.