Study of nitrogen-containing Cr(N) metallic nanocomposite coatings with addition of both Ag and Cu

PhD student: Xingguang Liu,
Supervisors: Dr Adrian Leyland and Prof Allan Matthews
Email address: mtp11xl@sheffield.ac.uk

1. Introduction and aims of my study

My studies will concentrate on the effects of adding both copper and silver into hard, nitrogen-containing Cr coatings prepared by unbalanced magnetron sputtering (and their resulting microstructure and properties), in order to attain coatings with promising properties for applications in automotive or antimicrobial fields, which is based on the solid-lubrication potential and natural antibacterial capability of both Cu and Ag.

There are two main aims of my study. The first one is to preserve the metallic state of Cr, instead of creating ceramic nitride phases (CrN), and meantime to make it be supersaturated by nitrogen atoms, in order to get high hardness over elastic modulus (H/E) ratio, which is proved to be more effective than extremely high hardness itself, especially so for coatings on soft substrates. The second one is to combine the different beneficial effects of cooper and silver on the tribological and antibacterial properties of nitrogen-containing chromium nanocomposite coatings.

2. Equipment and analysis

★ ***Deposition technique:***

Dual-target unbalanced magnetron sputtering, see Fig 1.

★ ***Evaluation***

- Wear test, including impact wear test, sliding wear test, pin-on disk wear test, etc.
- Observation of wear track, coating surface and microstructure.
- Analysis of chemical and phase composition, morphology and distribution.

Fig. 1. Magnetron sputtering deposition equipment (TECVAC)

3. Potential applications

★ ***Areas require self- lubricating and/or wear resistant properties.***

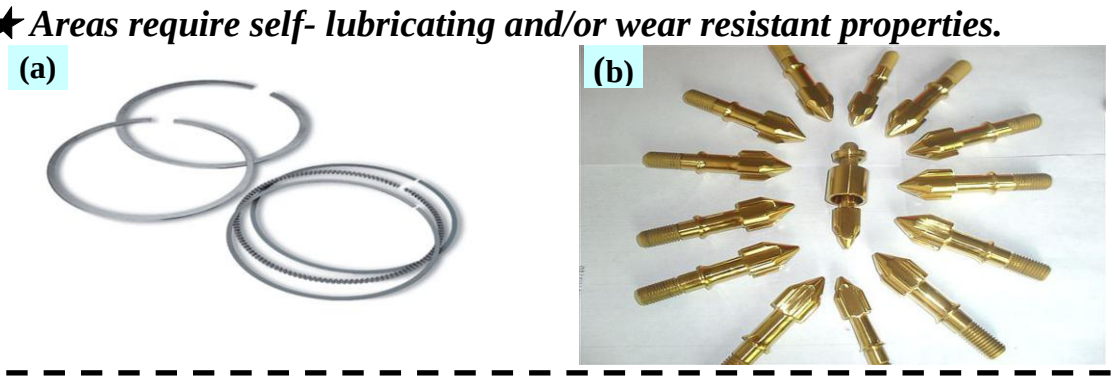

Fig. 2. Potential applications of Cr(N)-AgCu coatings produced by magnetron sputtering.
(a) Pistons rings of automotive engines,
(b) Machining tools.

★ ***Areas require good antibacterial abilities.***

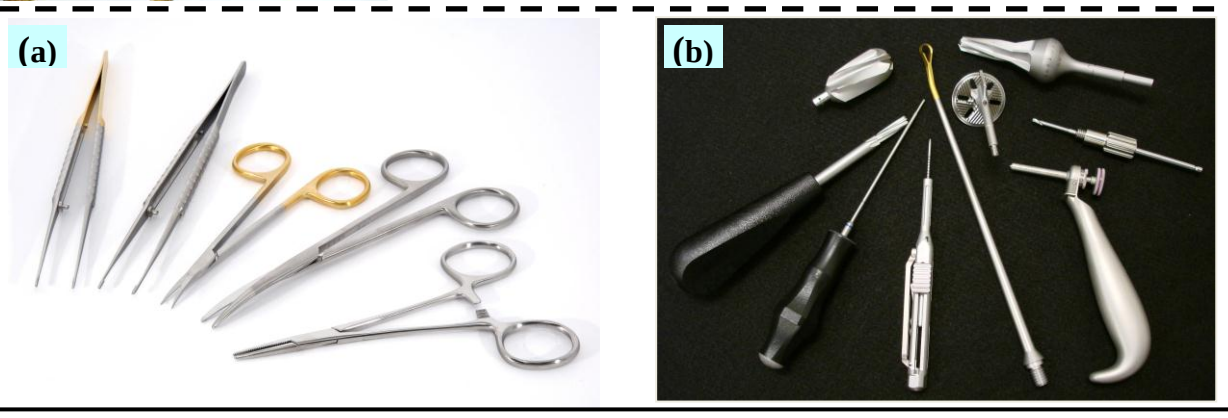

Fig. 3. Potential applications in medical instruments of Cr(N)-AgCu coatings produced by magnetron sputtering
(a) Surgical Instrument Set;
(b) Surgical Drill Guides and Cannulas.

Faculty of Engineering, Sir Fredrick Mappin Building,
Mappin Street, Sheffield S1 3JD, UK
T: +44 (0)114 222 5507

www.leonardocentre.co.uk