Antimicrobial "Super" Joints: Adding Silver to Titanium Nitride Physical Vapor Deposition Coating for Artificial Joints

Liu, Hanyue
Liu, Xiangting

Millions of people undergo joint replacement surgeries each year and the number continues to increase rapidly. Deep infection of artificial joints is a serious complication after surgery and often requires another surgery to remove the infected joint because traditional antibiotics is not effective on the implant surface. Physical vapor deposition (PVD) coating of Titanium Nitride (TiN) is used on artificial joints because of the superior mechanical properties of TiN coating. Our research has led us to create an antimicrobial TiN coating designed to prevent joint infection. Our hypothesis is that addition of silver (Ag) mixed in TiN coating will maintain the superior mechanical properties required for artificial joints and have antimicrobial effect to prevent deep infection. This idea was tested through an adapted testing procedure using E. Coli and Staphylococcus aureus bacteria. Various mechanic properties of the coating (hardness, adhesion, friction, etc.) were also tested. Results showed that although the mechanical properties of silver-doped TiN coating decreased slightly in comparison to pure TiN coating, antimicrobial effect proved to be significant. This new coating can be used to prevent deep infection in joint replacement surgeries. The antimicrobial hard coating also has other applications such as on dental implants and non-medical usage (e.g. on elevator buttons and door handles in public facilities).

Awards Won: