

## ANTIBACTERIAL EFFECT OF SOFT-METAL DLC NANOCOMPOSITE COATINGS FOR HIGHLY DURABLE ANTIBACTERIAL ADHESIVE TAPE

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### KEYWORDS

*Coatings; Biotribology; Wear, Antibacterial films*

### ABSTRACT

In order to limit the damage caused by infectious diseases such as the novel coronavirus disease (COVID-19) that began in early 2010, many indirect efforts have been made to minimize the amount of ingesting virus and reduce the risk of infection. Thus, antibacterial materials have been developed that have antibacterial and antiviral properties that kill and inhibit the proliferation of causative bacteria and viruses on the surfaces of objects that come in direct contact with hands and fingers. Especially, It has been reported that soft-metal such as (Ag) and copper (Cu) exhibit high bactericidal and antibacterial properties against many bacteria and viruses [1]. When the soft metals are used as antibacterial materials, not only in addition to using them as bulk materials, but the directly adding them to product materials or coating the surface with the plating films are used. However, since antibacterial and antiviral properties are limited to the solid surface, the use as a bulk material of soft-metal yields a large amount of the dead volumes that do not contribute to antibacterial properties. Or surface coating with the plating film of soft metal cannot be expected to have sufficient durability because it is worn away by repeated friction with fingers.

On the other hand, the friction and wear phenomena treated in the field of tribology are phenomena that occur at extremely thin frictional interfaces between objects that are in contact and move relative to each other. Diamond-like carbon (DLC) film that is known as an amorphous hard carbon film has attracted attention as an excellent tribo-material that reduces friction loss and improves wear resistance of mechanical elements, and many researches have conducted in both basic and application fields. Our research group has studied tribological properties of

soft-metal/DLC nanocomposite films in which Ag or Cu of soft-metals has been added during the film deposition [2]. If the high antibacterial properties of soft metals and the high durability of DLC are combined, the soft-metal DLC will have a new biological functionality, and it is expected that a highly durable antibacterial and antiviral coating that can withstand repeated friction with hands and fingers will be realized. In addition, by forming a film of soft metal DLC on a highly durable polyimide (PI) adhesive tape, it becomes possible to create an antibacterial adhesive tape that provides antibacterial properties when and where needed in the required area.

In this report, we have investigated the sustained effect of antibacterial performance of Ag or Cu contained DLC nanocomposite coatings deposited on PI substrate by RF magnetron sputtering using concentric composite target (CCT) under the friction with soft rubber simulating human fingers against *Escherichia coli*.

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