Manufacturing of Poly-DL-Lactic Acid Nanosheets and Evaluation of Tribological Characteristics between Nanosheet Surfaces and Fingers

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Abstract

Attention is focused on ultra-thin polymer films (nanosheets) that have high flexibility and adhesiveness and their thickness can be controlled to several tens of nanometers. These nanosheets can be neatly attached to surfaces with complex irregularities without the use of adhesives. Therefore, the ratio of surface area to thickness is very large, and we believe that the relationship with friction is very significant in nanosheet technology for biomedical applications such as wearable devices and wound dressings. The purpose of this study is to investigate the contact mechanism of nanosheets with human fingertip skin in terms of friction coefficient by using the microgravure printing method, which enables thin film coating. From the results of film thickness measurements, it was found that nanosheets of any thickness can be fabricated by the microgravure printing method. The friction measurement results showed that the coefficient of friction of the nanosheets decreased except for vertical loads above F_z=2N. The coefficient of friction increased as the contact area increased. It was found to increase with increasing vertical load under the immersion in water conditions, and conversely, it decreased under the drying condition except for the high normal load of 2N. Furthermore, the coefficient of friction was found to increase with increasing nanosheet thickness. Observation of wear traces showed that when the vertical load was sufficiently high (F_z = 2 N), wear traces containing oily traces such as sebum and sweat appeared on the nanosheet surface. This is thought to function as a lubricant. Polymer nanosheets are a new material, and there have been few studies on friction with this material. Research on friction is very important because polymer nanosheets are expected to be applied to wound dressings and displays of electronic devices.

Keywords: *Nanosheet, Fingertip, Friction, Real contact area, Friction of coefficient.*

1. Introduction

The nanosheets are a nanostructure that has thickness controlled to several tens of nm. Nanosheets have high flexibility and high adhesiveness and have received much attention in recent years. Since nanosheets have a very large surface area relative to their thickness, they can be neatly attached to complex uneven surfaces without adhesives [1][2][3][4]. Therefore, it is expected to be applied to devices such as wearable electronic substrates and wound dressings that are attached to the skin. By making the substrate of the wearable electronic device extremely thin, the size can be reduced without

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