

FUNDING PROGRAM FOR NEXT GENERATION WORLD-LEADING RESEARCHERS

Project Title: Creation of Functionalized Thin Film Lubrication Systems by Fine Patterning of Nanometer-Thick Liquid Films

Name: Hedong ZHANG

Institution: Nagoya University

1. Background of research

With the development of highly-sophisticated information society, the amount of electricity consumed by information technology (IT) equipment keeps increasing and may reach 20 percent of the total power generation in Japan by the year of 2025. As a high-capacity and low-cost information storage device, hard disk drives (HDDs) have been and will still be a crucial component among the IT equipment. It is consequently of global significance to reduce power consumption of HDDs. However, the lubrication technology for energy-saving next-generation HDDs has not been established yet.

2. Research objectives

To create lubrication surfaces with the desired function and performance, we are developing a method that selectively irradiates ultraviolet (UV) rays on nanometer-thick liquid lubricant films through a mask with transparent and opaque regions, thereby enabling fine control of the movement and conformation of the liquid molecules in each irradiated and nonirradiated area of 100 nm order. Applying the method to lubricant films coated on hard disk surfaces, we are aiming to achieve energy-saving ultrahigh recording density HDDs.

3. Research characteristics (incl. originality and creativity)

Nanometer-thick liquid lubricant films are divided into areas with different functions (functional patterns) by selective UV irradiation. This possibly enables creation of new properties superior to the inherent material properties. Additionally, we found for the first time in the world that the selective UV irradiation induces self-organized concave-convex patterns on nanometer-thick liquid films. Aiming to dramatically improve the lubrication performance of thin liquid films with such patterning method, this research is full of originality and creativity.

4. Anticipated effects and future applications of research

By establishing innovative lubrication technology, this research will promote the achievement of energy-saving next-generation HDDs and hence will contribute to the sustainable development of the information society. Moreover, this research is expected to contribute to the development in application fields of thin film lubrication such as micro-mechanical systems and automobile-related lubrication systems.