Visualizing frictional interface by surface plasmon resonance

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Abstract

Understanding sliding friction is important in designing machines. Sliding friction is caused by adhesion of very small asperities between two materials surfaces. However, the behavior of the asperities in between sliding materials can't be seen because of difficulties in observing frictional interface directly. Here, we are trying to visualize frictional interface by using surface plasmon resonance (SPR). Owning to high sensitivity of SPR against change in refractive index of contacting materials, we envision to visualize stress acting on frictional interface. To this end, we investigated frictional interface between a gold thin film and a PDMS, expecting visualization of acting stress because PDMS is known as varying its refractive index by ratio to deforming. Finding the relationships between change in refractive index and the magnitude of vertical force against PDMS on the gold thin film would enable to visualize frictional interface. In our experiments, we used a lubricant in interface between PDMS and gold thin film and compared refractive index of PDMS on the gold thin film before and after pushing PDMS. We found the difference between two SPR curves with and without stress. This result shows that refractive index of PDMS on gold thin film was changed and that we could capture the change in the frictional interface by SPR. We will quantify the relationship between vertical force and refractive index changing of PDMS in the future.