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Infrared Laser Irradiation of Gold Nanoparticles on Silicone for Bio-Interface Devices

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Abstract

Flexible and self-restoring nature of a wearable device is important for the stable sensing functionality of human activity signals such as EMG so that the printed electronic device and human body can be interconnected electrically with high robustness. For this purpose, we deposited conductive gold nanoparticles on an elastomer sheet by sputtering process. Irradiation of an infrared laser light onto the deposited silicone sheet was conducted for the enhancement of interface adhesion between the metal nanoparticles and the sheet polymer. In the experiment, silicone polymer sheet was cut in 25 mm x 25mm as a substrate. Micro-focused scanning CO_2 laser system (output power 0-50W) was used for the surface alteration of the gold nanoparticle deposited polymer sheet. In order to keep the planarity the polymer sheet was fixed on a flat slide glass and the laser spot beam was focused on the polymer surface. The laser power and the irradiation time were varied to clarify the irradiation effect on the gold nanoparticles-silicone interface. The irradiated surface of the substrate was observed by an optical microscope and FE-SEM. Surface texture after the laser irradiation was observed. The deposited debris was observed along the irradiated area. As the irradiated power increased the silicone surface was much ablated and exhibited fine structures. This fine structure was considered to be fabricated due to the thermal decomposition of smooth surface of the silicone polymer. The altered surface was found to be deformable after even severe elongation of the sheet which might be suitable for bio-interface.