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Formation of Conductive Layer on UV Modified PDMS (Poly-dimethyl-Siloxane) By Electroless Plating

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Abstract

Silicone polymers have the elasticity of rubbers with high chemical and thermal resistance, and the application of Silicone polymers bas been enthusiastically reviewed for MEMS and Nano technology as well as optical technology. There are many studies focused on dry method of metal layer formation on Silicone polymer to increase the level of its functionality. However, we have been exploring studies on wet method to deposit uniform metal layer on polymers even with complicated structures. Formation of metal layer on organic polymeric materials by wet method generally adds roughness to the targeted surface by chemical and physical etching then applies catalyst for the electro-less plating. However, this method is not practical since etching process degrades optical characteristics and material properties of polymers. In this study, surface reformation by UV treatment, where the effectiveness has been already verified on LCP (Liquid Crystal Polymer) and COP (Cyclo Olefin Polymer) [8, 9], was applied to Silicone Polymer to develop etching-free wet method for the application.

Key Words : PDMS, UV Irradiation, Peel Strength, Organic polymeric material

1. Introduction

Organic Silicone polymer is a hybrid material composed of inorganic Siloxane composition (Si-O-Si) and organic components such as methyl (MW : 5,000 ~ 10,000), and also an elastomer with a different structure compared to the usual organic polymeric materials. Siloxane has bonding energy (106 kcal/mol) that is much more stable than that of Carbon bond (85 kcal/mol). Therefore, Silicone polymer has great thermal resistance compared to organic synthetic rubbers due to the atomic bonding energy difference. Siloxane bond with large distance between atoms and large bond angle, has high rotational degree of freedom around the bonds. As they have less cross linking compared to organic synthetic rubbers, Siloxane bond can have various types of structures and hold characteristics of organic compounds in chain structures.

In addition, elasticity, mechanical strength, electrical properties, magnetic properties, and viscoelastic properties of Siloxane bond can be modified with different types of additives, which makes it a new material with many expectations in the field of MEMS (Micro Electro Mechanical Systems), Nano-devices, optical use and biomedical applications. Especially the Silicone polymer with PDMS (Poly-dimethyl-Siloxane) as its main component has outstanding optical properties and therefore is a promising material for the next generation of optical devices and applications [1- 5].

In order to upgrade Silicone polymer's high functionality, there have been many active research studies on formation of metal layer on Silicone

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