

*Regular Paper***Direct Pattern Formation by Electroless Anisotropic Growth Copper Plating on Liquid Crystal Polymer Using Selective UV Irradiation****Aung Myin OO^{1,2}, Mitsuhiro WATANABE², Hideo HONMA² and Osamu TAKAI^{1, 2}**¹Graduate School of Engineering, Kanto Gakuin University, 1-50-1 Mutsuura-Higashi, Kanazawa-Ku, Yokohama, Kanagawa 236-8501, Japan²Material & Surface Engineering Research Institute, Kanto Gakuin University, 1162-2 Odawara-shi, Ogikubo 250-0042, Japan

Received Dec. 23, 2017; accepted for publication Jan. 14, 2018

Abstract

Plating on plastic materials technology is widely applied in electronics-related fields. The choices of the electronic materials with the low dielectric properties are required for high-speed transmission and high frequency compatible circuit formation. Conventionally, in the transmission characteristics, the state of the interface between the resin and the conductor is important. However, although adhesion between the conductor and the resin is obtained by an anchor effect in the size of micrometers, it makes a factor of loss in high frequency transmission. A metal film with smooth surface can be formed by surface modification with ultraviolet (UV) irradiation and this technique led us to the examination of selective deposition with the UV irradiation. For this reason, it is desired to form a conductor on the smooth surface of the resin. Moreover, full-additive method was examined in order to reduce the number of steps of circuit formation and anisotropic growth plating technique is required. In this experiment, we found that a possibility of circuit formation by using inhibitor as pre-treatment to control the horizontal growth during plating.

Keywords: Direct Pattern Formation, Electroless Copper Plating, Anisotropic Growth, UV Irradiation

1. Introduction

The information society was become in last recent years, and the demands of high performance electronic devices have been increasing more and more. In printed circuit boards, circuit formation was suitable for high frequency and high-speed transmission was desired. For this reason, it is strongly recommended to use an excellent dielectric characteristics material, to form a circuit in which the influence of the skin effect is reduced. Nowadays, the circuit formation on the insulating resin is adhered by a rough surface of several micrometers. This is the so-called anchor effect. This surface roughness greatly affects the loss in signal transmission. In recent years, examination of circuit formation by anchor-less has been actively conducted. Moreover, an ideal circuit formation was suitable for low conductor loss is a circuit formation on a smooth resin surface. However, circuit formation on a smooth surface poses have a big problem in adhesion progress. In order

to solve this problem, we have reported that reforming method on various resin surfaces with nanometer level by UV irradiation technique and follow the plating on reformed surface. For the above background, we studied to form a circuit by selectively deposition of anisotropic electroless copper plating after irradiating ultraviolet where circuit is formed only the part of UV ray exposed [3]. Therefore, low dielectric properties of liquid crystal polymer materials were used. Normally, plating direction was grows equally not only in the vertical but also in the horizontal direction. Anisotropic growth plating is one of the plating methods that deposits preferentially in one direction.

In this experiment, we examined that the selective deposition and anisotropic electroless copper plating on the smooth surface by addition of 2-Mercaptobenzothiazole (2-MBT) inhibitor [4] as a pretreatment and confirmed its effect. 2-MBT is known as a stabilizer, but it also has the effect of suppressing the deposition reaction. By using this effect,

*Corresponding author: (m16J6002@kanto-gakuin.ac.jp)