Acid Proliferation Generator and Its Application in Computer to Plate

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A kind of acid amplifier called acid proliferation generator was proposed to produce acids in a manner of auto-catalysis. In view of its function in chemically amplified photoresists, we put forward a new application in Computer to Plate (CTP) and investigated its behavior in the process of imaging.

Keywords: acid proliferation generator, CTP, acid-catalysis

1. Introduction

The concept of acid proliferation reactions was proposed in chemically amplified photoresists, aiming at enhancing the photosensitivity of imaging, because an acid can be produced by an acid-catalyzed transformation of a precursor substrate to result in the increment of the amount of acidic species in a manner of geometric progression and the subsequent reaction rates could be enhanced exponentially. We call such a substance acid proliferation generator[1].

Many documents have revealed lots of acid proliferation generators were able to decompose to release strong acids as acid amplifiers to enhance the sensitivity of chemically amplified photoresists. For that, we find the imaging principle about chemically amplified photoresists and thermal cross-linking CTP plates have the similarity to some extent. CTP plates are applied to lithographic printing. This kind of plate that has an imaging layer that mainly comprises an admixture of (1) a resole resin, (2) a novolac resin, (3) a latent Bronsted acid, and (4) an infrared absorber that is capable of functioning in either a positive-working or negative-working manner exposed with a laser diode that emits a high-intensity infrared laser beam which provides enhanced image sharpness [2]. Figure1 is the reaction mechanism of the plate.

Fig 1 Mechanism of Reaction

(1) Two kinds of resins cross-link and form a latent image by acid-catalysis. (2) Baking time is about 2 minutes under the temperature of 100---120 centigrade degrees. (3) The exposed areas where contain image are left after developing.

During this process, the concentration of an acid catalyst, the rate of an acid proliferation reaction also results from the increase in acid concentrations. If it is added to the plate, an acid proliferation generator maybe enhances the velocity of producing acids and subsequent cross-linking reaction.

2. Method

We designed 1,4-cyclohexane bis(4-methyl-benzenesulfonate) as an acid proliferation generator, taking notice of the fact that a molecule can give the corresponding two-molar *p*-toluenesulfonic acids. And this novel acid amplifier was readily synthesized in a 50% overall yield by tosylation with *p*-toluenesulfonyl chloride and 1,4-cyclohexane diol in the presence of triethylamine (Et₃N) and 4-dimethylaminopyridine (DMAP).

Among these ingredients, resole resin, infrared absorber and acid proliferation generator were synthesized by ourselves. We mixed these ingredients to a scale, using an acid proliferation generator mentioned above replacing the Latent Bronsted acid. The resulting solution was spin coated onto an electrochemically grained and anodized aluminum plate. After that, the plate was exposed with a 500 mW diode laser which emitted a modulated pulse

centered at 830 nanometers. After imaging, the plate was heated in an oven, cooled and developed in an aqueous solution.

3.Results

The following Fig. 2 shows the results after developing.

Fig.2 Effect of post baking times on image formation.

From the above figure, we can see a) is over-baked, thus the unexposed areas can not be

removed entirely by developing. Charts b) and c) have relative good results and the only difference between them is c) has a slimmish line than b). And because of insufficient baking time, some exposed areas of d) are also removed after developing. On the other hand, we have done the experiments about a Latent Bronsted acid and the results show the coating of the plate will be all removed when the post baking time is less than 90 seconds.

4.Conclusion

The acid proliferation generator could be used in Computer to Plate to substitute the Latent Bronsted acid. And to some extent, it appears a superior sensitivity to the Latent Bronsted acid.

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