SOLUBILIZATION OF THE EPOXY RESIN SUBSTRATE USING GLYCOL

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Abstract

Metal recovery from electrical and electronic equipment waste, securing a stable supply of materials essential for the electronics industry as well as efficient use of resources, problems of land disposal site, contamination of soil and groundwater by organic halogen compounds and heavy metals leaching from landfills Is also important in terms of prevention,so technology development is essential to do. This research examined the conditions for using a glycol solvent with few bad influences for environment or a human body, solubilizing the glass-fabrics epoxy resin multilayer substrate currently most used abundantly as a printed circuit board by ordinary pressure, and separating a metal. As a result, it turned out that the diethylene glycol and dipropylene glycol which includes the ether linkage in molecular structure solubilizes an epoxy resin. The epoxy resin was solubilized 100% by heating by a boiling state for 6 hours with the diethylene glycol solvent which added sodium hydroxide.

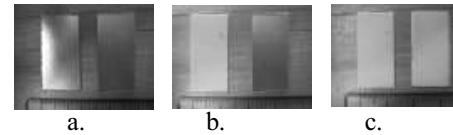
Keywords: *Electric device waste, Printed circuit board, Solubilization, Glycol, Metal recovery*

1.Introduction

Electrical and electronic equipment such as computer and television,which is widely used metals and antimony. These metals are essential for the manufacture of electronic products, but there are worried about long-term supply of land for production is unevenly distributed [1]. The valuable metal content of waste electronic equipment is said to be 10 to 100 times the weight of natural resources,it can be call Urban Mines. However, they are often heavy metals or halides, it is difficult to include the processing of thermosetting resins, plastic device itself.It just being still largely landfill [2]. Metal recovery from electrical and electronic equipment waste, securing a stable supply of materials essential for the electronics industry as well as efficient use of resources, problems of land disposal site, contamination of soil and groundwater by organic halogen compounds and heavy metals leaching from landfills Is also important in terms of prevention,so technology development is essential to do. This research examined the conditions for using a glycol solvent with few bad influences for environment or a human body, solubilizing the glass-fabrics epoxy resin multilayer substrate currently most used abundantly as a printed circuit board by ordinary pressure, and separating a metal.

2.Materials and Methods

The sample was the Glasscross epoxy resin laminate substrate (CEL-475 made by RISHO KOGYO CO.LTD), one side in order to determine the effect of solubilization of the metal substrate surface area, were etched on both sides(Figure 1). Solvents are glycerin (GLY), ethylene glycol(EG), diethylene glycol(DEG), propylene glycol(PEG), diepropyrene glycol(DPG) 5 ~ 20g, and additives is sodium hydroxide 2-6%.



a. b. c.

Figure 1 a). Normal sample. b).The sample which etched one side. c). The sample which etched both sides.

Figure 2 shows a schematic diagram of the experiment. Sample tube, the solvent is filled with additives, 10 minutes after raising the temperature in each set temperature, hold time for each set. Set temperature to the boiling point of each solvent plus 50 ℃ minutes and light component is cooled and refluxed by cooling tubes. This experiments performed pressure, air atmosphere and were recorded sample temperature and the gas temperature every minute. After the reaction, the solvent is recovered in the vial. Epoxy boards are tetrahydrofuran (THF) was washed using ultrasonic, dried and weighed, equation (1) was calculated based on the solubilization.

$$\text{Solubilization rate}(\%) = \left(1 - \frac{A - C}{B}\right) \times 100 \quad (1)$$

A: Weight of epoxy substrate before the reaction
B: amount of epoxy resin contained in the substrate
C: Weight of epoxy substrate after reaction

3.Results and Discussion

3.1 Comparison of solvent

The solubilization rate of sample c in each solvent is shown in Fig. 3. Additive is NaOH3%, and reaction time

was 2 hours. The solubilization rates of DEG and DPG are 73% and 51%, respectively, and the laminated glass fiber was separated. In other solvents, it was not fully able to solubilize. DEG and DPG have an ether linkage in the configuration. It was shown that a solvent with an ether linkage is effective in solubilization of an epoxy resin.

3.2 Effect of additive amount

Varying percentage of the amount of solvent added in each of solubilization were examined. Figure 4 shows the percentage of each fraction soluble additives. A sample was C and reaction time was 2 hours. Solubilization rate of diethylene glycol epoxy board shows that rely heavily on the concentration of additives. The other three solvents major changes in solubilization rate but varying concentrations was no additives. Be effective in solubilization of the donor group showed no OH or H, are stable in the solvent additives, so I suspect is happening, or neutralization.

3.3 Effect of reaction time

We used diethylene glycol solvents, additives of NaOH3%, considered the effect of reaction time. Figure 5 shows the hourly rate of solubilization of the reaction. The solubilization rate has increased as a longer reaction time but 100 % of solubilization rate of 6,8 hours, so both can be considered that the reaction is completed at the time of six hours. But the resin in the fiber can be confirmed yet at 1,2,4 hours,the substrate after 6,8 hours to complete separation of glass fiber, has a beautiful white.

3.4 Effect of surface metal

We used diethylene glycol solvents, additives of NaOH3%,considered the effect of surface metal(Figure6). Samples are etched on one side was about two hours the reaction came up curled side but after reaction the sample was about 8 hours peelable by hand. The separation of the substrate without etching the glass fiber could not see, much better rate of solubilization in a longer reaction time.

4. Summary

The experiment which solubilizes a glass cloth epoxy resin multilayer substrate by ordinary pressure with a glycol solvent was conducted.

When diethylene glycol was used, NaOH3% was added and it heated by the boiling state for 6 hours, it turned out that the sample which carried out double-sided etching can realize 100% of solubilization. Since the result in which the sample of an one side etching process is also almost the same was obtained, we considered that the application to a real waste base is possible.

References

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[2] T.Kamo , electronic materials, 49, pp.165-168, (2010)

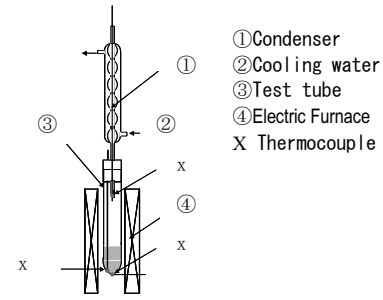


Figure 2. Schematic diagram of the experiment

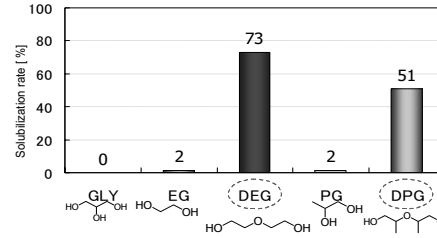


Figure 3 The solubilization rate of each solvent

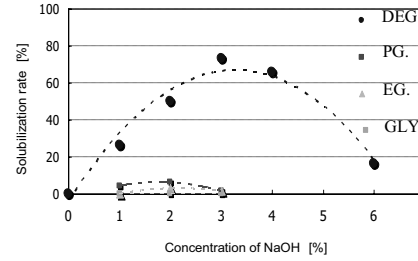


Figure 4 Effect of the additive in each solvent

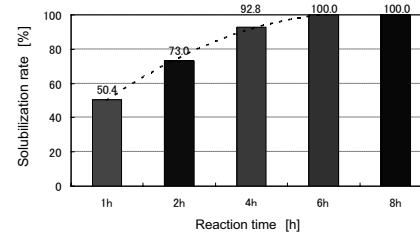
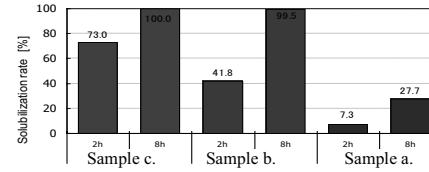


Figure 5 The solubilization rate for the reaction time



Fifure 6 Influence of the surface metal exerted on a solubilization rate