

Affecting of Corrosion Potential and Current Density on Variation Polarization Curves with Polycarbonate [III]

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1. Introduction

Natural polymers are the basis of all life processes, and our technological society is largely depend on synthetic polymers (Chang, 1994; Brydson, 1995). Undoubtedly the 1970s will similarly be known as the environmental, ecological, or pollution decade, for it is in this decade that environmental pollution has become a popular cause for concern. Much of the material spoken and written about environmental pollution has been presented with great emotion from a position firmly on one side or the other of the issues (Stocker, 1972). But, the corrosion of polymers has not been previously reported. So that, this paper is our first attempt to correlate corrosion tests executed by electrochemical method. In this study, we have also determined the detailed influence of variation factors such as temperature and pH. Also, we obtained corrosion effect of the enzyme (Castro, 1989) and salt.

2. Experimental

Polycarbonate obtained from Aldrich Chemical Company, Inc. Electrochemical and polarizing measurements were performed in chloroform or dimethylformamide. The supporting electrolytes was tetrabutylammoniumperchlorate(TBAP) (G.F.S.Chemicals), or lithium perchlorate(Aldrich), which was used as received. The supporting electrolyte concentration was typically 0.10M. The electrode tip of a working electrode system may consist of a 1cm² silver piece in area (thickness 0.1mm) of conducting material, which together with a silver wire for electrical conduct is sealed perpendicular to the rod(wire) axis. The reference electrode get used to the saturated calomel electrode(Ag/AgCl: KOSLOW SCIENTIFIC COMPANY. P/N 1004), and graphite carbon rod was used as a counter electrode and electrolysis cells were of conventional design. Solutions for electrochemistry were typical 1mM in the redox-active species, and were deoxygenated by

purging with prepurified nitrogen for at least 8 min. All experiments were performed at a scan rate of 7 mV/s by CMS100 and 105(Gamry Instruments, Inc) with a computer. The pH was measured with pH meter(ORION model 960) conductance was measured with a ORION model 142. Tafel plots were obtained from -1.0 to +1.5 V region at the steady state potential. The pH of the solution was controlled by sodium hydroxide or hydrochloric acid. It was added to magnesium chloride in order to observation an effects of salt. A enzyme(Citrate: Fluka, Lipase: Aldrich, grade reagent) dissolve at a concentration of mg/ml(unit) in nonaqueous.

3. Results and Discussion

3.1 Electrochemical Polarization Characteristic of pH from Added Salt

The Fig.1 shows the electrochemical polarization curves of polycarbonate in nonaqueous solvent (chloroform and dimethylformamide (80:20)). Corrosion tests were carried out to determine qualitatively the effects of several variables on the corrosion of polycarbonate in 0.1M magnesium chloride solution. The Fig.1 shows the effect of pH on cathodic and anodic polarization of polycarbonate in 0.1M MgCl₂. The solution was air saturated and one atmosphere of air filled the free space of the autoclave at room temperature (Do, 1992).

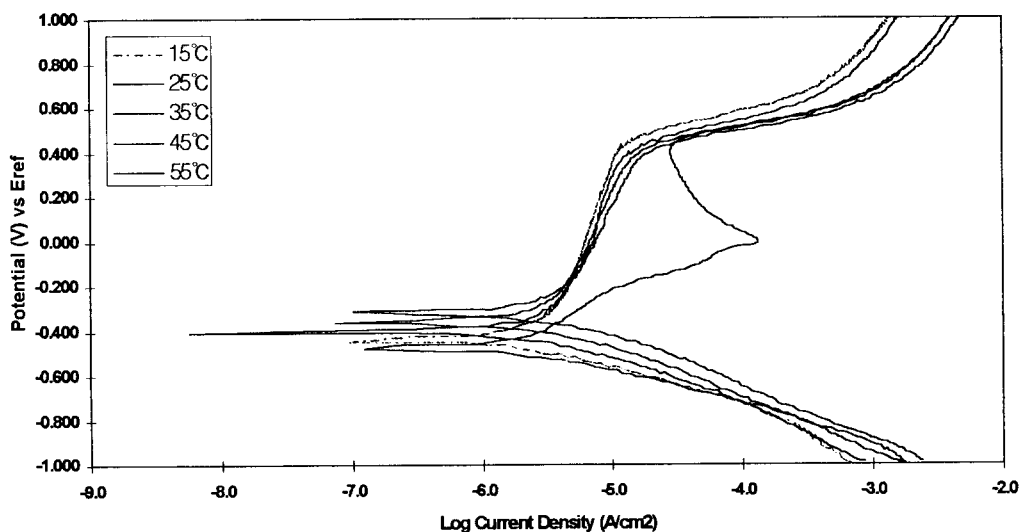


Fig. 1. Polarization curves of polycarbonate(polymer) in nonaqueous solvent. (contained dissolving oxygen)

4. Conclusion

The corrosion polarization curves of polycarbonate in 0.1M MgCl₂ exhibits a total of three redox waves. The potential efficiency of the 1st wave exhibited to cathodic reduction potential when the 2nd and 3rd waves were kept for the anodic oxidation potential at all temperatures. The best corrosion temperature efficiency was at 30°C to 35°C and corrosion pH efficiency was near at pH 5.0. and 9.0.

The best condition of pH and temperature for corrosion rate was found to be pH 5.0 in acidity, and pH 9.0 in alkalinity at 25°C. The resistance effect of temperature and pH were speculated that it was decreased the gradual minimum at 25 and 55°C and it was small near on pH 5.0 in acidity and on pH 7.0 and 11.0 in alkalinity. The best corrosion temperature for enzyme(Citrate) added was at the 35°C, pH 5.0. The corrosion of polycarbonate was known to be rapidly oxidation by enzyme catalyzed. The susceptibility effect of pH and temperature increased when it was the from pH 5.0 to 11.0 at 25°C.

The effect of mass transfer was obtained more than $\alpha = 0.5$.

Accordingly, these reaction exhibited to electrode reaction that it is totally irreversible.

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