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배전케이블내 고분자 절연체의 절연성능에 미치는 불순물의 영향평가

조영신 · 심미자* · 김상욱
서울시립대학교 화학공학과, *생명과학과

Evaluation of Effects of Impurities on Insulating Properties of Polymeric Insulator in Power Distribution Cable

Young-Shin Cho, Mi-Ja Shim*, Sang-Wook Kim
Dept. of Chem. Eng., *Dept. of Life Sci., Seoul City Univ.

Abstract: To evaluate the effects of impurities on insulating properties of polymeric insulator in high electric power distribution cable, OIT and OMT were measured. By using Eyring plot, the thermodynamic parameters of ΔH and ΔS could be obtained.

1. Introduction

Polyethylene is the most widely u polymer in the electric power c industry. Coss-linked polyethylene(XL especially, has been used for elect insulating parts of high voltage ele power distribution and transmission because of its excellent dielec properties, such as high diele strength, low dielectric loss and dielectric constant at wide frequency further more flexibility and good the properties[1]. Power cable insulated XLPE is generally operated at h temperature around 75℃ and somet oxygen presence condition a oxidized[2,3]. So checking the oxid resistivity of the insulation is important to characterize the polym insulator.

Most of the evaluating technique electric power cable was electr method but recently the thermal chemical characterization of polym insulating materials were proposed.

OIT(oxidative induction time) OMT(most oxidative time) are us method to evaluate the cable insula Activation entropy and enthalpy for compensation plot can be derived the Eyring equation. Eq.(1) shows relationship between OMT and oxidi temperature in Eyring plot[4,5].

$$\log(tT) = \log\frac{h}{k} - \frac{\Delta S}{k'} + \frac{\Delta H}{k'}\frac{1}{T} \quad (1)$$

where t: OMT, T[K]: oxidiz temperature. h: Plank constant(6.6 10^{-34} Js), k: Boltzmann constant(1.3 10^{-23} J/K), $\Delta G(=\Delta H - T\Delta S)$: Gibbs energy in activation process. From various test results, it is possible evaluate the oxidation stability an compare the oxidation degradation time.

2. Experiments

The polymeric material used in study was XLPE which is the m insulating part of CN/CV 22.9 underground power distribution c

(Hanil Power Line Co., 60 mm^2). sample was heated to a spec temperature from room temperatur the heating rate of 10℃/min and ret for 5 min to stabilize the DSC base Then the ambient N_2 gas was chan into O_2 gas flowing at the same r OIT and OMT were detected from shifting point of the DSC base line the oxidative exotherm peak on D curves, respectively. By using Ey plot of Eq.(1), the thermodyn parameters were obtained.

3. Results and Discussion

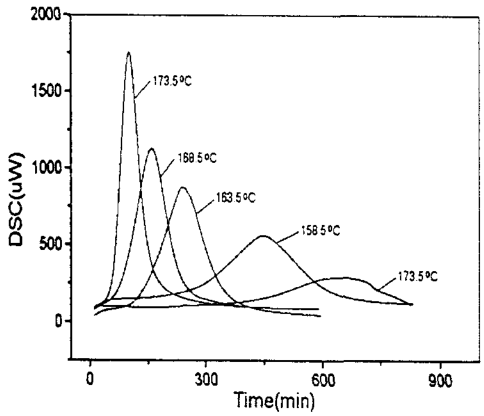

Fig. 1 DSC curves of XLPE at diffe temperatures under dry O_2 flowing at the rate of 50 ml/m

The DSC curves of XLPE at different temperatures are shown in 1. As the heating temperature oxidizing temperature increased, exothermic curve became sharp showed high DSC value. As oxidation temperature decreased, OIT and OMT decreased. But the of the exothermic curve or to exothermic heat showed almost the s value.

Fig. 2 shows OIT and OMT value

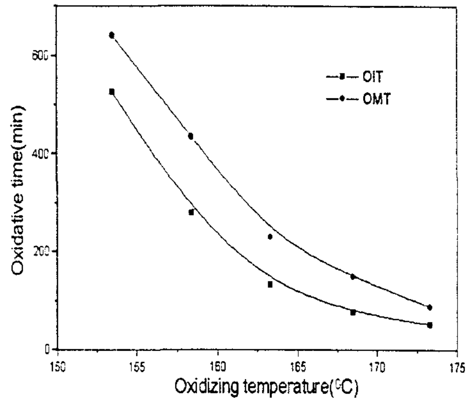

Fig. 2 Effects of oxidation temperat on OIT.

with oxidation temperature. thetemperature increased the increased rapidly. The value of the depends on the test specimen cond especially specific surface area[5]. instance, as the surface area incre the oxidation process shows steep s in DSC curve and it is easy to determ the OIT value. But the peak valu DSC curve doesn't matter with oper The surface area exposed to oxy should be similar for all specimens te to get reliable data. The larger the of the specimen surface area to its m the better defined is the oxida exotherm and the easier it is to d the OIT and OMT values. As oxidation temperature decreased, exothermic curve showed broad and was not clear to define the intercep increasing exothermic curve and D base line.

Fig. 3 shows the OMT data plot in the Eyring co-ordinates. Data for sample yield very good fit to the Ey equation(1). The slope and intercep the line in Fig. 3 corresponds to ΔH ΔS value, respectively. The tempera T in Fig. 3 is the oxidizing temperat

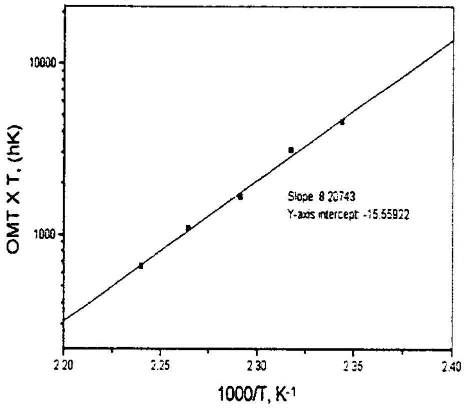

Fig. 3 OMT of XLPE in Eyr co-ordinate.

in the OIT tests. k′ is 2.3026×k. slope or $\frac{\Delta H}{2.3026\,k}$ is 8.207 so that is 26.088 $\times 10^{-23}$J. The intercept(-1 of Y-axis is $\log\frac{h}{k} - \frac{\Delta S}{2.3026k}$ so tha the calculated ΔS is 23.01798×10⁻ At various specimen condition, the v can be calculated and compared other. A. Bulinski, et al.[5] examine effects of the laboratory-aging and aging conditions on the plots correlated aging condition and compensation curves. Various specim are being tested and the results wi discussed next.

Acknowledgement

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