에폭시 마이크로-나노 입자가 혼합된 콤포지트의 열적특성에 관한연구

A Study on Thermal Properties for Epoxy Micro-and-Nano Mixture Composites(EMNC)

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Abstract : This study investigates the thermal and mechanical properties of insulation elements through mixing epoxy based micro- and nano particles. Regarding thermal properties, DSC and DMA were used to calculate crosslinking densities for various types of insulation elements. In a mechanical property of bending strength, shape and scale parameters were obtained using the Weibull plot. This study obtained the most excellent results of scale parameters, such as Vol 3.2%, in the bending strength of EMNCs.

Key Words :

1. 서 론

In particular, epoxy resins are applied to dry mold transformers and power CT/PT. Also, solid insulated switchgear(SIS) and gas insulated switchgear(GIS) require a large insulation spacer in order to support internal conductors. In general, it is essential for heavy apparatus systems as not only electric rotating machineries but static mold machineries. The epoxy resin is to be filled by certain micro scaled fillers (silica or alumina) in order to obtain low thermal expansion using some conductors, such as aluminum or copper [2]. The conventional filled epoxy that has low thermal expansion avoids the exfoliation between conductors caused by some thermal cycles or epoxy casting sections. In addition, it is required due to the heat generated during the operation of heavy apparatuses. The mechanical and electric properties of insulation materials at high temperature (about 100'C) determine the performance of these apparatuses and that assure a step further in the realization of environmental friendly heavy apparatuses by using it to solid insulation systems without using SF6 gas [3].

2. 결과 및 토의

Although the crosslinking density of the original epoxy resin was 0.15971mol/cm^3,theglasstransitiontemperaturewas132.82℃. However, in the case of the EMNC(6.2Vol%), the crosslinking densities of the composites without and with the Silane processing were 0.37873 and 0.25593, respectively, where the glass transition temperatures were 134.48 and 133.42℃, respectively. The differences of the crosslinking density between the original epoxy resin and the composites, EMNC(6.2Vol%), without and with the Silane processing were presented by high levels, such as 137.1% and 60.2%, respectively. There are large differences in the mobility between the molecular chains of the original epoxy resin and EMNCs. It can be seen that the composition between the particles of the EMNCs was densely achieved relatively. As a result, it may affect their thermal and mechanical properties and electrical insulation breakdown significantly at some sections of high temperature. However, in the comparison of the crosslinking density between the original epoxy resin and the conventional micro composites, the difference of the crosslinking density was a low level as much as 435%. It can be considered that the interface was fatally weakened by a loose coupling between the micro filler and the polymer matrices as the micro SiO2 particles were changed to composites by mixing them into epoxy resins.

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