Dielectric Properties of Series Joined Silicone Rubber and Epoxy Resin Formulations

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***Abstract*–Dielectric frequency spectroscopy of polymer materials were done in laboratory. The aim was to investigate the (i) differences in dielectric losses of the industrially manufactured silicone rubbers against laboratory manufactured silicone rubbers, (ii) differences in dielectric losses for the epoxy resin samples manufactured in laboratory, but with different curing time, and (iii) differences of dielectric losses between each single polymer to the losses of the series joined specimens of the two polymers. The measurements were done using the Insulation Diagnostics System in laboratory at ambient room conditions. It has been found out that for different frequency ranges, silicone rubber manufactured industrially differ with the laboratory manufactured specimens. The series joined specimens show higher influence of the silicone rubber in both curve shape, and values of losses at frequencies lower than 1 Hz. At frequencies lower than 1 Hz the joined specimen losses are higher than losses for epoxy resin and lower than those for silicone rubber. At frequencies higher than 1 Hz the losses of the joined samples are close but slightly lower to those of epoxy resin and higher than those of silicone rubbers. Lastly, the curves of the joined specimens have shapes which strongly resembles those of the silicone rubbers.**

***Index Terms*–polymers, insulation, dielectric, relaxation, losses**

I. INTRODUCTION

Polymeric materials are gaining more usage worldwide in outdoor insulation systems; as a result, there are various researches which have been undertaken to investigate their properties (Boudefel & Gonon, 2006; Ehsani et al., 2007; Wang et al., 2000). These researches have made it possible to have state of the art polymer insulators, which have been proved to be effective in transmission lines. Within these researches, dielectric properties investigation has had its fair share (Tuncer, 2004, 2005), since these measurements can tell the molecular, ionic and electronic state of the dielectric which are vital for the effective performance of polymer insulator (Jonscher, 1999; Nguyen et al., 2004; Zong et al., 2005). These ongoing researches are vital since they are important in researches of diagnostic tools of outdoor polymeric insulators (Nixdorf & Busse, 2001; Thadei, 2010), level of conduction of these dielectrics (Thadei & Kyaruzi, 2008; Tuncer & Gubanski, 1999, 2000), their molecular structures (Serdyuk et al., 2002; Tuncer, 2004, 2005), detecting ageing effects (Kumara et al., 2022; Seifert et al., 1998) and mechanical failures of the central rod (Ogbonna et al., 2022). Epoxy resin is an important component for polymer insulators, in the formation of the polymer matrix (Uflyand et al., 2022). Polymer insulators are preferred because

The series joined specimens show similar shapes for all specimens as shown by curves in Figure 6 except for specimen E241PS. The curves of joined specimens are between those of epoxy resin specimen and silicone rubber specimen as shown in Figure 7. At frequencies lower than 1 Hz the joined specimen losses are higher than losses for epoxy resin and lower than those for silicone rubber. At frequencies higher than 1 Hz the losses of the joined samples are close but slightly lower to those of epoxy resin and higher than those of silicone rubbers. Lastly, the curve of the joined specimens have curves which strongly resembles those of the silicone rubbers.

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