Abstract

The primary objective of this thesis is to outline a comprehensive framework to reduce the research gap towards the applicability of the nanofluids based on mineral and biodegradable oil as a next generation liquid dielectric used for high voltage equipment. For this purpose, the suitability of established electrical-based condition monitoring methods created for insulating systems of the future i.e. nanofluids based on mineral and biodegradable oil insulation is thoroughly studied. The normal service life of large transformers is approximately 40 to 50 years. For the establishment of an enhanced dielectric liquid than mineral and vegetable oil the following properties like better dielectric strength, efficient cooling, lower dielectric losses, lower electrical conductivity, high fire resistance, biodegradability, high thermal conductivity etc. must be possessed. In this context, a proper inspection on dielectric properties is needed. Time domain spectroscopy and frequency domain spectroscopy methods are the preferable methods to investigate dielectric properties. For conducting the experiments, different set-up has been developed in Jadavpur University by the author which is presented in the thesis. Different stable nanofluids taking mineral oil or vegetable oil as base oil have been developed and their dielectric properties have been compared with mineral and vegetable oil. Then, effect of the multi nano particles presence in base oil on the dielectric properties has been investigated. After that, stable mixed oil based nanofluids have been prepared and check their applicability as transformer oil in terms of dielectric properties. Observations and findings of several researchers in the relevant field are reported in this thesis. Besides, for addressing the issue of temperature and moisture effect on nanofluids, different mathematical models have been proposed. Experiments performed with another developed samples and show satisfactory results, thereby proving the validity of the proposed schemes.