PREFACE

High voltage insulators are the backbone of electrical power transmission lines. High voltage Insulators are commonly fabricated using ceramic porcelain material and its various derivatives. The ceramic porcelain insulator (CPI) has various attractive properties such as enhanced mechanical strength and superior electrical properties (high resistance, high dielectric strength with a low dielectric loss). The CPI shows persistent behaviour for nearly 30 years under adverse environmental conditions such as hot, saline, and humid environments The CPI is preferred over other types of insulators i.e., glass, polymers and other composites material due to the wide availability and low-cost of raw materials used for the fabrication of CPI. The essential raw materials used for the manufacturing of CPI contains kaolin, ball clay, feldspar and silica.

Chapter-1 discusses a brief introduction to porcelain insulator their application and important raw materials. A detailed literature survey on the porcelain insulator have been carried out, it helped to identify more suitable effective material and methods for the preparation of base material for ceramic porcelain insulator.

Chapter-2 in this chapter presents the method or techniques for manufacturing of samples of ceramic porcelain insulator, its measurement, and subsequent characterization were studies.

Chapter-3 Chapter 3 describes the effect of alumina and silica addition on the Physico-mechanical and electrical properties of porcelain bodies over high sintering temperatures. The pellets were prepared in different shapes and dimensions with the help of hydraulic press machine by pressing at 160 MPa for a period of 10-minutes. Different characterizations techniques such as; dilatometer, X-ray diffraction (XRD), and scanning electron microscopy (SEM) used to evaluate the thermal, structural, and microstructural changes, respectively. The measurement of electrical, mechanical and physical behavior were analyzed for all the samples prepared with different compositions of alumina and silica with varying sintering temperature (1250 and 1350°C).

Chapter 4 describes the effects of sintering on the mechanical and electrical properties of ceramic porcelain insulator reinforced by zirconia (ZrO_2) particles. The different composition having different zirconia (ZrO_2) concentration (i.e., 0, 10, 20, and 30 wt. %) are prepared using the uniaxial pressure method applying 160 MPa pressure. The samples are sintered at 1250°C and 1350°C with a heating rate of 5°C min^{-1} and the soaking period is 2 hours. Further, observed the effects of zirconia addition on mechanical and electric properties of porcelain insulator. Different characterizations such as Dilatometer, x-ray diffraction, scanning electron microscopy and differential thermal analysis (DTA) / thermo-gravimetric analysis (TGA) was used to evaluate the thermal, phase detection, microstructural and weight loss changes by increasing concentration of ZrO_2 on base porcelain composition.

Chapter 5 describes the effect of zirconia concentration (0, 2.5, 5, 7.5 and 10 wt. %) addition on the physical, mechanical, and dielectric properties of an alumina-based ceramic insulator. The pellets were prepared using the uniaxial pressure technique applying 160 MPa pressure. Different characterizations techniques such as; XRD, dilatometer, and SEM used to identify the phase, thermal and microstructural changes, respectively of the sintered samples (1350°C). The value of dielectric, resistivity, and conductivity were also measured.

Chapter 6 describes the effect of $BaTiO_3$ (0 to 2 wt. %) addition on the physical, mechanical, dielectric property and dielectric strength of prepared porcelain insulator. $BaTiO_3$ (BT) is used to increase the electrical characterization of the prepared ceramic porcelain insulator composition. Further prepared samples were sintered at 1350°C with the heating rate of 5°C/min. The microstructural phase and composition analysis characterization was done using scanning electron microscopy (SEM)/ EDS and XRD to understand the structure-property relationship of the insulator. Also, measure the mechanical and electric properties, i.e., dielectric constant, dielectric loss at low (20 Hz to 1 MHz) and microwave frequency (1 to 20 GHz).

Chapter 7 gives the summary of whole thesis in nutshell and present the future scope and application of this work in research and development area.