Zirconia based geopolymer matrix to reduce antenna size

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Volumetric antennas have interesting characteristics in many fields of electronics and communications. Some of them (detection, location and identification of buried items) require the use of antennas operating over a wide frequency band of [100MHz; 3GHz]. In this frequency range the volumetricantennas need to have compatible dimensions and weight with portable systems moved by human strength. Therefore, it seemed interesting to design volumetric antennas filled with a high permittivity dielectric material in order to reduce their size and make them portable. However, we have dielectric assessment tools in different frequency ranges that allows us to analyze their dielectric properties (the relative permittivity, and dielectric loss (tan (δ))) according to various formulation of geopolymer. Accurateelectromagnetic models can be extracted from these measurements and implemented in EM simulation software for accurate design of antennas.

In this context, geopolymer formulations containing different zirconium oxide rates were synthesized in various experimental conditions.The zirconium oxide is addedto the metakaolin either by substitution or by insertion;then the mixture was added to the alkaline solution. The samples will be kept at different temperatures (25, 40 and 70 °C) and at varying moisture content (12, 65 and 85%).Samples were poured into a mold of 80*80*15 mm^3dimensions.

The first permittivity measurements are promising.For example, a formulation containing 30% of zirconium oxide in insertion and synthesized at a temperature of 20°C and with humidity rate of 70 %, displays value of real relative permittivity $\boldsymbol{\varepsilon'_r}$ and dielectric loss tan(δ) of 4and 0.035respectively.