HIGH TEMPERATURE MICROWAVE DIELECTRIC PROPERTIES OF CERAMIC NANO AND MICROPOWDERS.

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ABSTRACT

The problem of microwave enhanced mass transport in solids remains an area of great interest and continued research in the microwave processing of materials. Many researchers have reported that microwave sintering of materials reduces the time and often the temperature of the sintering procedure [1]. The mechanisms of the mass transport enhancement phenomenon by microwaves termed "Microwave Effect" are not clear and certainly much further investigation is required.

From a practical point of view, the complexity of the various ceramic microstructures and the presence of several diffusion mechanisms involved in sintering make the identification of the nature of the Microwave Effect a non-trivial task. In addition, microwave heating is a volumetric process resulting in high temperature gradients towards the outer boundaries of the material where the temperature is lower, which can enhance the sintering process [2]. Therefore, the need to study less complicated systems has emerged [3]. The use of nano-structures has been shown to lead to a reduction in temperature and/or time for processes involving mass transport. The small size also ensures uniformity of the electromagnetic field across an individual particle resulting in uniform heating [3].

Previous researchers have shown that the dielectric and electric properties of many interesting ceramics [4] depend upon the size of their grains. This means that one can anticipate different behaviour of the same material with different grain size, under the presence of a microwave field. Furthermore the lately developed ponderomotive theory [5-10] accounts for a mass transport mechanism, which occurs near the grain boundary surface, and certainly systems with higher surface to bulk volume ratio can provide valuable information.

Thus, the dielectric characterisation of such nano and micro structures is of prime importance in order to understand and predict their behaviour under a microwave field.
This paper will present preliminary results of a study of the microwave dielectric properties of ceramic nano and micropowders at room and elevated temperatures. These results will be compared and similarities and differences will be pointed out.

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