

Production and development of tungsten based complex perovskite oxide ceramic components for temperature sensors for petroleum wells

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Abstract

In petroleum production, different types of sensors are required in the petroleum wells to monitor temperature, pressure and other vital parameters. These sensors have to work in very hostile environmental conditions. Thus it is of prime importance they should exhibit extremely inert and stable behavior in such environmental conditions. In case of temperature sensors, normally, sensing elements are metals such as Au, Pt, Nb etc. which are very sensitive to environmental conditions and in this way they need to be embedded in highly inert materials. Ceramic embedded temperature sensors i. e., thermistors, are quite suitable and frequently used for these purposes. Commercially such sensors are available in the international market but at a exorbitant prices. Presently we are working on development and fabrication of parallel type of thermistors using different types of complex perovskite oxide ceramics, which are highly inert in hostile environmental conditions. In above context, in the present work we have developed and characterized a tungsten based complex perovskite oxide ceramics Ba₂MWO₆ (where M ∈ Ni, Mg). These ceramics were produced in form of circular discs (15 mm diameter and 2mm thickness) by solid-state reaction process and sintered at different sintering conditions in the temperature range 1200 to 1600°C. Microstructural characteristics of sintered Ba₂MWO₆ studied by scanning electron microscopy, show a homogenous surface morphology and particle size distribution, which is of vital importance for quality and mechanical strength of ceramic products. Initial electrical characterizations reveal a quite stable behavior of dielectric constant and loss factor values at 1-2 GHz frequencies of these sintered ceramics. In terms of above favorable characteristics, we are in the process of fabrication of Pt based thermistors using Ba₂MWO₆ ceramics. Results and their implications are presented and discussed in this work.