

BaTiO₃/Metal Multimaterials for Power Electronics: SPS and Cold Sintering Process Approaches

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In power electronics, obtaining metallized ceramic substrates that combine capacitor properties with high-voltage resistance remains a major challenge. Consequently, the development of BaTiO₃/metal multimaterials in a single step is interesting for power electronics applications. In this work, we compare different sintering methods enabling the co-sintering of BaTiO₃/metal assemblies.

A functionally graded (FGM) BaTiO₃/Nickel is developed by co-sintering via Spark Plasma Sintering (SPS). The powder synthesis procedure, cermet composite preparation, and sintering behavior of both systems are presented. The structure and microstructure of the resulting materials are discussed, with particular attention to the metal-ceramic interface, characterized by scanning and transmission electron microscopy to clarify the adhesion mechanism. The dielectric properties of BaTiO₃ are further investigated as a function of post-SPS annealing time, using broadband dielectric spectroscopy and dielectric breakdown strength tests, in order to determine the optimal annealing duration for the targeted electrical properties.

SPS processing is known to induce partial reduction of BaTiO₃, related to the reducing conditions and high temperatures involved, which degrades its dielectric properties and requires this corrective annealing step. The Cold Sintering Process (CSP), operating at low temperature, offers a promising alternative route for producing BaTiO₃/metal assemblies without this reduction issue.

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