

Thick Film Processes for Ferroelectric Films and Devices

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Thick film technologies are well established in the electronics industry for the deposition of a wide range of conductive, dielectric and resistive materials. In general, powder-based starting materials are combined with polymers and solvents to make viscous inks which can then be deposited onto a substrate. The common approach is to mix low melting point glass phases, or frits, into the ink in order to standardise the sintering temperature across a wide range of material types. This enables circuits and components comprising a number of different materials to be co-fired, thus facilitating cost effective manufacturing, albeit with inferior properties compared to bulk materials. In the last few years there has been considerable research efforts in producing ferroelectric and piezoelectric thick films, both to use for devices on suitable substrates and to integrate with other technologies (e.g. silicon) in MEMS applications. This paper will review the approaches that have been taken in the processing of ferroelectrics material in thick film form – low temperature and high temperature. Processing issues will be exemplified from our own work on lead zirconate titanate and barium strontium titanate thick films and devices. The relationships between the composition, microstructure and dielectric properties of the films and the film/substrate interface will be discussed, together with the implications of the results for circuit and device design.