

The Characterization of Thick-Film Resistors on Dielectric-on-Steel Substrates for Strain Gauge Applications

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The compatibility of several types of 10 k Ω /sq. thick-film resistors (Du Pont QM-84, QM-94 and 8039, ESL 3414-A, and Heraeus 8241), which were developed for firing on alumina substrates, with insulated metal substrates, as well as the compatibility of some thick-film multilayer dielectrics (Du Pont QM-42, ESL D-4914 and Heraeus IP-222-SL) with stainless-steel substrates were evaluated. Sheet resistivities, temperature coefficients of resistivity (TCR), noise indices and gauge factors of the resistors fired on alumina substrates and on dielectric-on-steel substrates, were measured. The TCR values of most resistors, fired on the dielectric-on-steel substrates, are higher than the TCRs of resistors on alumina substrates, which is attributed to the higher thermal expansion coefficient of the stainless steel. Some “combinations” have very high and irreproducible gauge factor values, which is attributed to the incompatibility of the resistor and dielectric materials. At the interface between the dielectrics and the steel substrates, no interactions or evidence for new phases could be detected, which indicates the compatibility of the evaluated dielectric materials and the stainless steel.

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