## Abstract

Surface acoustic wave (SAW) sensors fabricated on high-temperature piezoelectric substrates have attracted considerable attention due to their properties. Because it is important to model the SAW devices accurately, a simulation study of Rayleigh wave properties based on a stacked Al/AlN/Si (100) device was achieved, in this paper. Evolution curves of acoustic phase velocity, reflectivity and electromechanical coupling efficiency; for different aluminum (Al) electrode patterns and different piezoelectric aluminum nitride (AlN) layer thicknesses, were elaborated by 2D FEM COMSOL simulations. Added to that, the simulated acoustic mode shapes and the harmonic admittance of the device were represented. The best (AlN) layer thickness and electrode width were 1.5µm and 1µm respectively; they were deduced from the obtained SAW characteristics curves. After that, we used the deduced parameters for the conception of one port resonator temperature sensor working at a frequency of 1.166GHz. Using an elaborated theoretical temperature model coupled to FEM model, frequency shift induced by the SAW device temperature variation was evaluated from the return losses (S11) parameter curves in a range of (-25°C to 200°C). The relative frequency change was about 0.17% and the sensor's sensitivity was evaluated at 8.53ppm/°C.