A critical need exists for sensors that can monitor physical quantities such as temperature, pressure, strain, and corrosion at strategic locations of components operating in harsh environments up to 1000°C. Stable sensor materials and robust packaging must be developed so that the sensors can withstand these demanding environments and be used effectively in applications such as aircraft turbine engines, power plants, automotive diagnostics, and industrial process control. We have developed surface acoustic wave (SAW) sensors based on langasite (La$_3$Ga$_5$SiO$_{14}$) piezoelectric crystals that remain stable to at least 900°C. A major challenge for this technology is to develop oxidation resistant metallic electrodes and ultra-thin passivation coatings that can mechanically protect the active sensor surface, yet allow interaction with the environment. This talk will discuss the synthesis and properties of nanostructured Pt-Rh/ZrO$_2$ thin film electrodes and ultra-thin SiAlON and ZrSiN passivation coatings, as well as show results from prototype SAW sensor devices operating at high temperatures.

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