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A STUDY OF THE APPLICABILITY OF GALLIUM ARSENIDE AND SILICON CARBIDE AS AEROSPACE SENSOR MATERIALS.

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Most of the piezoresistive sensors, to date, are made of silicon and germanium. Unfortunately, such materials are severely restricted in high temperature environments. In this study, by comparing the effects of temperature on the impurity concentrations and piezoresistive coefficients of silicon, gallium arsenide, and silicon carbide, we seek to determine if gallium arsenide and silicon carbide are better suited materials for piezoresistive sensors in high temperature environments
(T > 1400 ^{0}C). The results show that the melting point for gallium arsenide prevents it from solely being used in high temperature situations, however, when used in the alloy $Al_xGa_{1-x}As$, one gets not only the advantage of the wider energy band gap, but also the higher desired melting temperature. Silicon carbide, with its wide energy band gap and higher melting temperature suggests promise as a high temperature piezoresistive sensor.

MATERIALS	MELTING POINT (^{0}C)	ENERGY GAP (eV) (Room Temperature)
Silicon (Si)	1412	1.12
Silicon Carbide (SiC)	2830	2.86
Gallium Arsenide (GaAs)	1240	1.424
Aluminum Gallium Arsenide ($Al_xGa_{1-x}As$) (x is alloy composition)	$1511-58x+560x^2$ (solidus curve) $1511+1082x-580x^2$ (liquidus curve)	$1.424+1.247x$ ($x<0.45$) ($1.9+0.125x+0.143x^2$) ($0.45<x<1.0$)