J. Appl. Phys. **66**, 90 (1989); http://dx.doi.org/10.1063/1.343861 (*7 pages*)

Surface acoustic wave properties of aluminum gallium arsenide

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(Received 29 October 1987; accepted 20 February 1989)

Surface acoustic wave (SAW) properties are measured for {100}-cut, ⟨100⟩-propagating aluminum gallium arsenide ($Al_xGa_{1-x}As$) with x=0.2 and 0.4. The parameters used to characterize these properties are SAW velocity, SAW attenuation, and piezoelectric coupling coefficient. The measured velocities are found to be substantially higher than those on GaAs in agreement with the theoretical predictions of Adachi. The attenuation is close to the corresponding attenuation on GaAs which is approximately 1 dB/μs. The piezoelectric coupling coefficient is measured using two independent methods and is found to be significantly higher than that of GaAs. This means that the transduction of energy from electrical to acoustical is more efficient and hence acoustic charge transport devices on $Al_xGa_{1-x}As$ substrates will require considerably less rf drive power. An extensive literature search has revealed no previous work, theoretical or experimental, characterizing attenuation or piezoelectric coupling of SAW on $Al_xGa_{1-x}As$. The velocity has been predicted by Adachi based on a model formulated by Keyes, and has been measured by Sapriel, but the measured velocities reported herein correspond to the predicted values much better than the values measured by Sapriel. The measurement technique described has not, to the authors' knowledge, been previously used for measurement of the piezoelectric coupling coefficient, and represents a convenient method of obtaining the SAW parameters experimentally.

KEYWORDS and PACS

Keywords

ALUMINIUM ARSENIDES, GALLIUM ARSENIDES, ACOUSTIC SURFACE WAVES, VELOCITY, ATTENUATION, PIEZOELECTRICITY, CHEMICAL VAPOR DEPOSITION

PACS

43.35.Pt
Surface waves in solids and liquids

43.35.Cg
Ultrasonic velocity, dispersion, scattering, diffraction, and attenuation in solids; elastic constants

43.58.+z
Acoustical measurements and instrumentation

ARTICLE DATA

Digital Object Identifier

http://dx.doi.org/10.1063/1.343861

PUBLICATION DATA

ISSN

0021-8979 (print)
1089-7550 (online)

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