

Measurement of Leaky Surface Acoustic Wave Velocity Using A Liquid Delay Line Oscillator

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As a simple nondestructive method of measuring the leaky surface acoustic wave (SAW) velocity distribution of a sample, the introduction of a liquid delay line oscillator using interdigital transducers (IDTs) for the leaky SAW is investigated. The longitudinal wave emitted from a transmitting IDT into water is mode-converted to the leaky SAW on the sample surface. The longitudinal wave reradiated into water is detected as a delayed electrical signal at a receiving IDT. The detected electrical signal is fed back into the transmitting IDT via an amplifier. The oscillation frequency is strongly affected by the velocity of the leaky SAW propagating on the surface of the test object. Thus, the distribution of the leaky SAW velocity of the sample can be measured in the form of the change of oscillation frequency. The method is simple and suitable for automated measurement.

1. Introduction

In the design of the surface acoustic wave (SAW) device, the SAW velocity on the substrate material is one of the most essential material constants. Therefore, it is important to measure the distribution of SAW velocity on the wafer surface in the production of SAW devices.⁽¹⁾ In particular, the quality management of the piezoelectric ceramic wafer is an important issue because the distribution of the SAW velocity on the piezoelectric ceramic is larger than that on the single crystal.

Various methods for measuring the SAW velocity distribution of a test piece have been reported. For example, a technique called the $V(z)$ curve method,⁽²⁻⁵⁾ us-