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Nondestructive Evaluation of Si and GaAs Ingots Using Ultrasonic Computed Tomography

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In the production process of Si or GaAs ingots for an integrated circuit element chip (IC chip), an article of inferior quality is sometimes produced. In order to meet engineering demands for the nondestructive inspection of such ingots, ultrasonic computed tomography is applied herein. In tomography, the propagation time of ultrasound is used to measure data. In the nondestructive inspection of such ingots by ultrasonic CT, the distribution of constituent elements and the differences in their crystal orientation are investigated. From these results, it is found that these inferior qualities can be sufficiently distinguished by the time of flight of the ultrasonic CT imaging. Relative CT imaging, which is compared with standard CT imaging of the section with superior quality, is also shown as an evaluation.

1. Introduction

A number of integrated circuit elements (IC) are used widely in modern engineering, and these are mainly based on the silicon (Si) chip, which is manufactured by cutting a large Si ingot. GaAs is also an important material, and uniform quality is expected to be maintained in the manufacturing of GaAs ingots. However, an article of inferior quality is sometimes produced; this is caused mainly by the nonuniform distribution of constituent elements, and lattice imperfections, for example. Therefore, it is very important to inspect the material nondestructively before cutting ingots into small chips.