

Microscopy of Integrated Circuits*

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Abstract

As the techniques employed by manufacturers in the formation of integrated circuits become more advanced and involved, the failure rate of these devices tends to increase. To diagnose and rectify these conditions, a simple trouble-shooting sequence should be developed. This sequence should contain the proper instruments to show the failure modes and should be applied in such a way that no test or examination interferes with or destroys other areas of the device which must be examined later.

This paper deals with the role of microscopy in determining the causes of failure in integrated devices.

Introduction

During the past few years miniaturisation in electronics has given way to microminiaturisation and the result of this evolution is the integrated circuit. In much the same way that plant and animal cells are biological building blocks, integrated circuits are electronic building blocks. They are responsible for radical changes in instrumentation which are of increasing importance to scientist and layman alike. It is interesting to notice that the development, manufacture and testing of these devices have necessitated the use of almost every existing scientific instrument.

Integrated circuit devices are inherently very reliable. They are, however, very small and very complex solid-state devices and many things can go wrong during manufacture or use. It is therefore imperative to be able to determine the causes of failure and to institute any necessary changes in production technique or handling. Failure analysis has grown out of this need and has become an important part of production and manufacture of integrated circuitry. The test gear required for failure analysis ranges from electrical testing equipment to the electron microprobe analyzer.

* Presented at INTER/MICRO-69, London, England.

