The Rigaku Journal
Vol. 14/ number 2/ 1997

Product Information

Wafer/Disk
ANALYZER 3640

1. Introduction

The Rigaku Wafer/Disk Analyzer series debuted as a dedicated wafer analyzer in 1977, at the dawn of the semiconductor industry. Since then, its function and performance have been improved upon and upgraded on a timely basis to meet the increasingly diversified and sophisticated needs according as the rapid progress of LSI technology. This analyzer series has kept pace with the development of thin film materials, ever larger wafer sizes, automation with the cassette-to-cassette robot, and so on. The 300 shipment of this series was celebrated In July 1995, when a System 3630 was installed.

The System 3630 was first developed in 1992 to handle 16 M to 64 M DRAMs. While there are still growing demands for this analyzer reflecting the continued expansion of 64M DRAM plants in Japan, Korea and Taiwan, new analytical requirements of this analyzer are surfacing as the ferrodielectric memory, a next-generation memory, and 1 G to 4 G DRAMs are coming into use.

The Wafer/Disk Analyzer 3640 introduced here was developed as an advanced model capable of handling next-generation memory. Therefore it is equipped with new functions for this purpose in addition to the application capability, hardware and software already developed in this series.

The Wafer/Disk Analyzer Series will continue to be used actively in and outside Japan as a tool to support the technological innovation of LSIs.

2. Features

(1) Distribution measurement function to handle next-generation memory

Ferrodielectric memory utilizes $Y1(SrBi_2Ta_2O_9)$ and PZT $(Pb(Zr_{0.4}T_{0.6})O_3)$, etc. Thin film materials like $SrTiO_3$ and Ta_2O_3 are used for 1 G to 4 G DRAMs. In ferrodielectric film analysis, diffracted X-rays which occur when using the primary beam X-rays on Si wafer can cause errors.

Such diffracted rays are produced when Si wafer has a certain direction. Analysis without diffraction effects can be made by properly choosing the direction of the Si wafer.

A newly developed $XY\theta$ sample stage was incorporated to permit XY driving while the Si wafer direction (θ) is kept constant. This allows high-precision distribution measurement of thin films containing heavy elements without the adverse effect of diffracted rays.

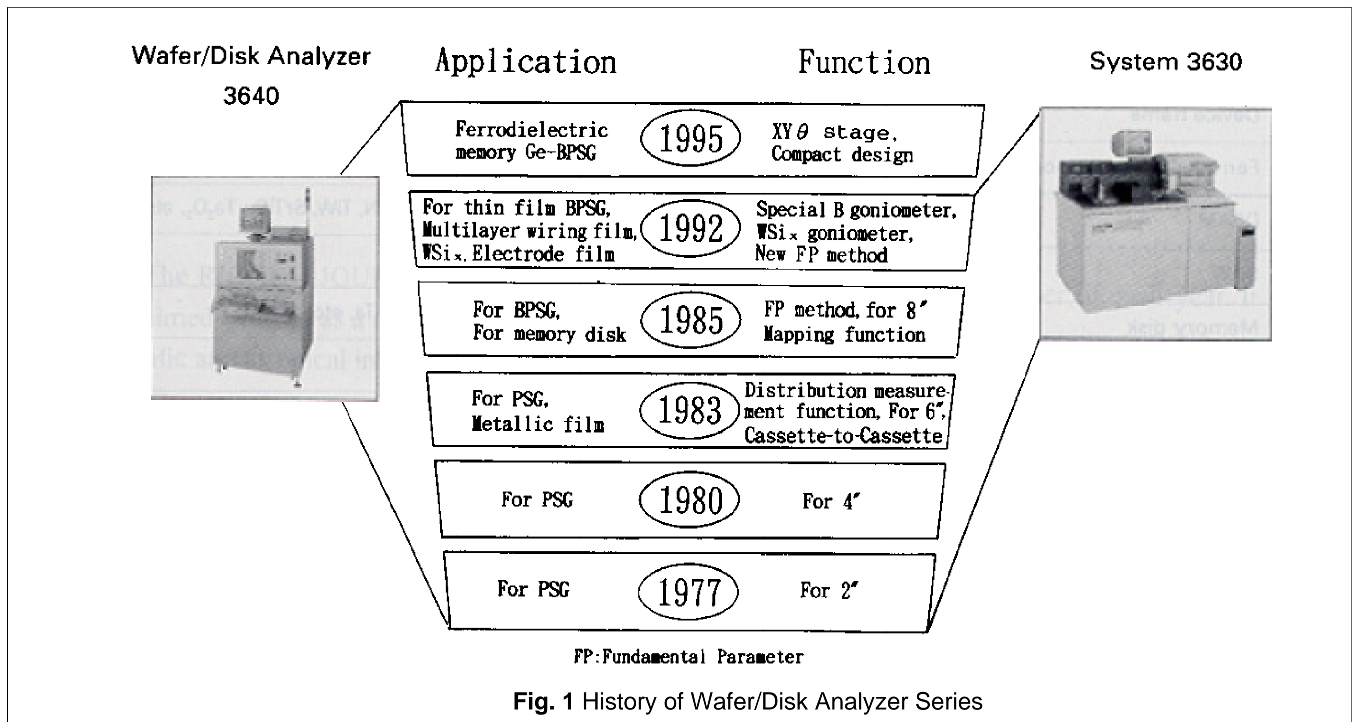

Fig. 1 History of Wafer/Disk Analyzer Series

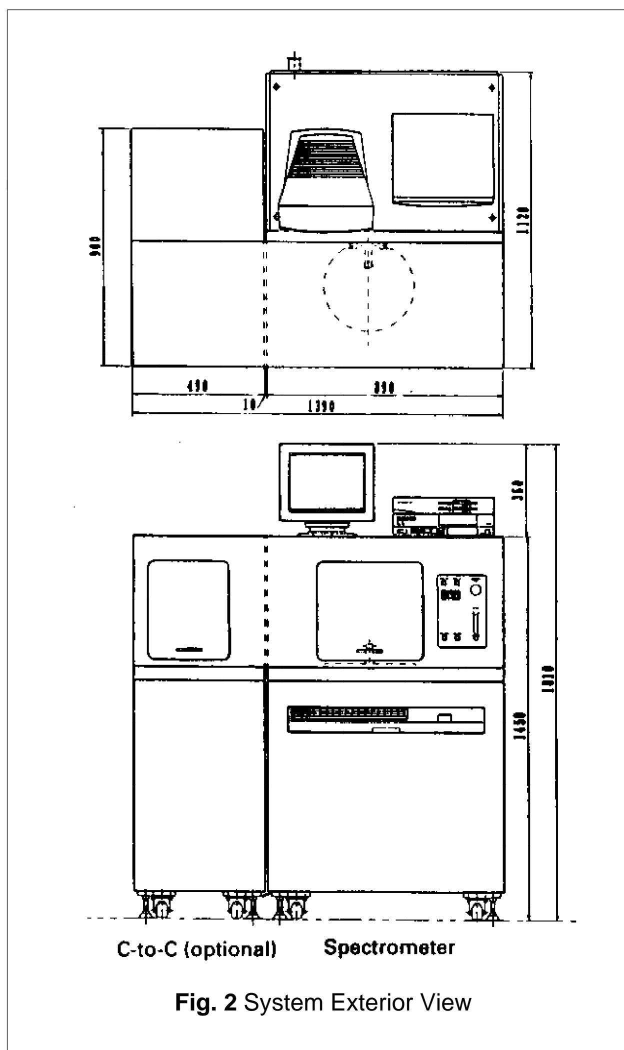

Fig. 2 System Exterior View

(2) Compact size

The footprint of the main body of the 3640 is less than 1 square meter (890 (W) x 1120 (D) mm). This compact size maximizes the efficiency of clean room utilization.

(3) Enhanced analytical precision

The use of a new X-ray tube has improved the analytical precision for BPSG, WSix, polysilicon, etc.

(4) High throughput utilizing the Cassette-to-Cassette (C-to-C)

A wafer handling robot is used to quickly adjust the orientation flat/notch of a succeeding wafer while measurement is under way. As a result, the throughput has improved.

(5) Easy-to-use software

Each section of the system is collectively displayed on a clear, illustrative screen. The system status can be confirmed at a glance. Additionally, online and offline analysis (such as SECS) can be made without switching menus, leading to enhanced operational productivity.

3. Application

In addition to the ferrodielectric memory and DRAM, the Wafer/Disk Analyzer 3640 is also applicable to SAW (surface acoustic wave) device, memory disk, magnetic head, etc.

Table 1 Application

Device name	Object of analysis (thin film material)
Ferrodielectric memory	Y1, PZT, BST, Pt, etc.
DRAM	BPSG, PSG, Ge-BPSG, SiO_2, Si_3N_4, polysilicon, Wsix, Al-Cu, Al-Si-Cu, TiN, TiW, $SrTiO_3$, Ta_2O_5, etc.
SAW	AlSiCu (substrate: SiO_2, $LiNbO_3$, $LiTaO_3$, etc.)
Memory disk	Co-Ni-Cr, Cr, Ni-P, C, fluorine-contained lubricant film, Fe-Tb-Co, Se-Te, etc.
Magnetic head	Fe-Ni, CoNbZr, etc

4. Specifications

Item	Specifications
Sample chamber	Sample size: 8” max. (A holder is available according to the size.) Sample stage: XYθ driving system, spin mechanism (for center measurement)
Goniometer & detecting section	Elements for simultaneous analysis: 16 elements max. Goniometer: Fixed type goniometer for each element Scanning type goniometer (for Ti through U) Collimator: 2 kinds for automatic exchange (Select from 5, 10, 15 and 20 mm dia.) Automatic vacuum degree controller: 13 Pa ± 1 Pa (APC: automatic pressure controller) Temperature stabilizer: Available
X-ray generating section	X-ray tube: Rh target, 3 kW X-ray generator: Maximum output: 3 kVA Heat exchanger: Distilled water recirculation system (with ion exchange resin)
Vacuum pump	Dry pump (QDP-80)
Cassette-to-cassette	(Optional), orientation flat/notch adjustable
Data processor	Software: Multiwindow/multitask FP method for multilayer thin film Wafer measuring direction setting program, etc. Mapping (optional) Personal Computer: DOS/V compatible Operating system: OS/2 Warp CD-ROM, 15” color CRT, ink jet printer