International Journal of Advanced Technology in Engineering and Science
Vol. No.4, Issue No. 12, December 2016
www.ijates.com
ijates
ISSN 2348 - 7550

SCANNING ELECTRON MICROSCOPE

Shraddha K. Waikar[1], L. N. Bansode[2]

[1]*Department of Physics, Shivaji University, Kolhapur (India)*
[2] *Department of Physics, Shankar rao Mohite Mahavidyalaya, Akluj (India)*

ABSTRACT

(SEM) is one of the most versatile instruments available for the characterization of heterogeneous material and surfaces on micrometer and sub-micrometer scale.
SEM generates image by scanning the specimen with a beam of electrons. The electron beam from an electron gun is allowed to pass through electromagnetic lenses before falling on sample. The electromagnetic lenses are used to focus the electron into a very thin beam. The finely focused electron beam is allowed to sweep rapidly over the surface of specimen. The molecules in the specimen are excited to high energy levels in this process and emit secondary electrons. Apart from secondary electrons, back scattered electrons, characteristics X –rays and photons of various energies are also produced. Primarily, the electrons so produced are used to form an image of specimen surface.The image is signal is collected by detector. The display device provides for both visual observation and photographic recording. Thus SEM extracts structural information of thin film material.

Keywords: Detector, Electron Gun, Electromagnetic Lenses, Electron Microscope

I INTRODUCTION

Electron microscopes are scientific instruments that use a beam of highly energetic electron to examine objects on a very fine scale. Electron microscope which are limited by Physics of light. In the early 1930's there was a scientific desire to see the fine details of the interior structure of organic cells. This require 10,000 X plus magnification which was jus tnot possible using light microscope.

History of Electron Microscope

Year	Invention
1897	J J Thomson discovered electron
1924	Louis DE Broglie identified electron
1926	Knoll and Ruska built first electron microscope
1938	First practical microscope built by Siemens
1940	Commercial microscope with 2.4 nm resolution
1945	1.0 nm resolution

SEM discovered by Von Arden in 1938 by rastering the electron.

Secondary Generations of SEM	Year	Name of scientists/Institute
I	1938	Von Arden
II	1942	Zworykin
III	1965	Cambridge

II PRINCIPLE

Basic principle is that a beam of electron is generated by suitable source, typically tungsten filament or field emission gun. Electron beam is accelerated through high voltage and pass through system aperture and electromagnetic lenses to produce a thin beam of electron. Then beam scan the surface of specimen, electron are emitted from specimen by action of the scanning beam and collected by suitable detector.

III CONSTRUCTION

1) Electron Gun: - It has two types

i) **Thermionic guns:** It commonly used, apply thermal energy to filament to coax electrons from gun and toward specimen. They made up from tungsten

ii) Field emission guns: It create strong electrical field to pull electron away from atom.

2) Condenser Lenses: - It used to produce clear and detailed images. They aren't made up from glasses but they made up from magnet which capable of bending the path of electrons.

3) Objective Aperture:- Objective arm above the objective lens. It is metal rod that holds metal plate containing four hole. Over this fit a much thinner metal material with aperture. It can narrow the beam below the aperture, depending on size of hole selected.

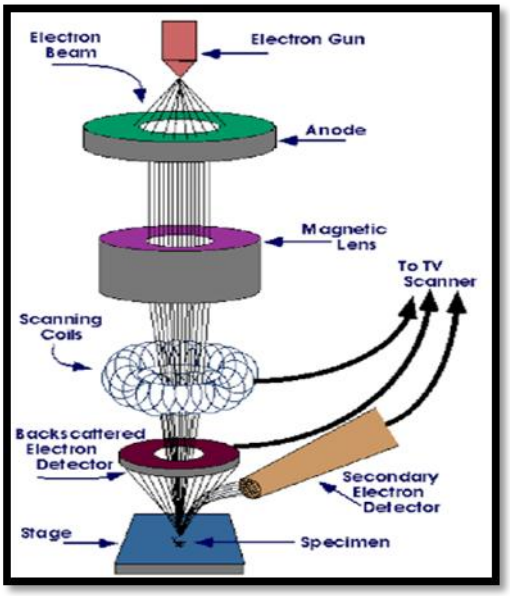
4) Scan Coil: - They are made up of two solenoid.

5) Chamber [Specimen Test]:- Here specimen is placed for examining. Chamber must be sturdy and insulated on ground floor of building.

6) Detector: - Detectors are as the eyes of microscope, they detected the various ways that the electron beams with sample.

7) Vacuum Chamber:- Without vacuum electron beam generated by electron gun would encounter constant interference from air particle in atmosphere.

IV RAY DIAGRAM OF SEM



4.1 Working of SEM

SEM uses focused electron beam over specimen, which kept inside the chamber and system is evacuated. Typical voltage is about 1-30 KV is applied across the filament of electron gun , then emit electron from tungsten filament, those electrons attracted by electrodes and accelerate them into energetic beam System of magnetic lenses brings electron beam to very fine focus electron beam .electron beam scan across sample and provide scattered electron Detector detects these signals electron which is then fed to photo multiplier tube and displayed on display tube.

4.2 Sample Preparation

Here included following steps.

1] Cleaning the surface of specimen
2] Stabilizing the specimen
3] Rinsing the specimen
4] Dehydrating the specimen
5] Drying the specimen
6] Mounting he specimen
7] Coating the specimen

4.3 Uses

Topological**,** morphological**,** compositional information a scanning electron microscope can detect and analyze surface fracture, provide information in microstructure, examine surface contamination, identify crystalline structure provide qualitative chemical analysis. It is essential research tool in fields such as life science, bio gemology, medical, forensic science .

REFERENCE

Journal Paper

H. M. Pathan, C. D. Lokhande, Bull. Mater. Sci, 2004

B. D. Cullity, Elements of X-ray Diffraction, Addeson-Wesley, London, 1978, second Ed.

Book

K. L. Chopra, Thin film phenomenon, McGraw –Hill book company, NY 1969