Radiation protection -practical lecture 1 Geiger-Muller Detector

Asst.Lec.Dumoaa Haider Shakir

introduction

The Geiger counter is an instrument used for measuring ionizing radiation used widely in such applications as radiation dosimeter, radiological protection, experimental physics and the nuclear industry.

- It detects ionizing radiation such as alpha particles, beta particles and gamma rays using the ionization effect produced in a Geiger- Müller tube; which gives its name to the instrument.

- In wide and prominent use as a hand-held radiation survey instrument, it is perhaps one of the world's best-known radiation detection instruments.

Basic components

consists of two parts, the tube and the (counter + power supply)

- A Geiger counter consists of a Geiger-Müller tube, the sensing element which detects the radiation, and the processing electronics, which displays the result.

- The Geiger-Müller tube is filled with an inert gas such as helium, neon, or argon at low pressure, to which a high voltage typically 400- 600 V is applied.


counts per second
series 900 mini-monitor
MINI

Types Of Geiger-Muller Counter

- Broadly, there are two main types of Geiger- Müll

End Window Type:

- For alpha particles, low energy beta particles, and low energy X-rays, the usual form is a cylindric
- This type has a window at one end covered in a thin material through which low-penetrating rad can easily pass. The other end houses the electrica connection to the anode.

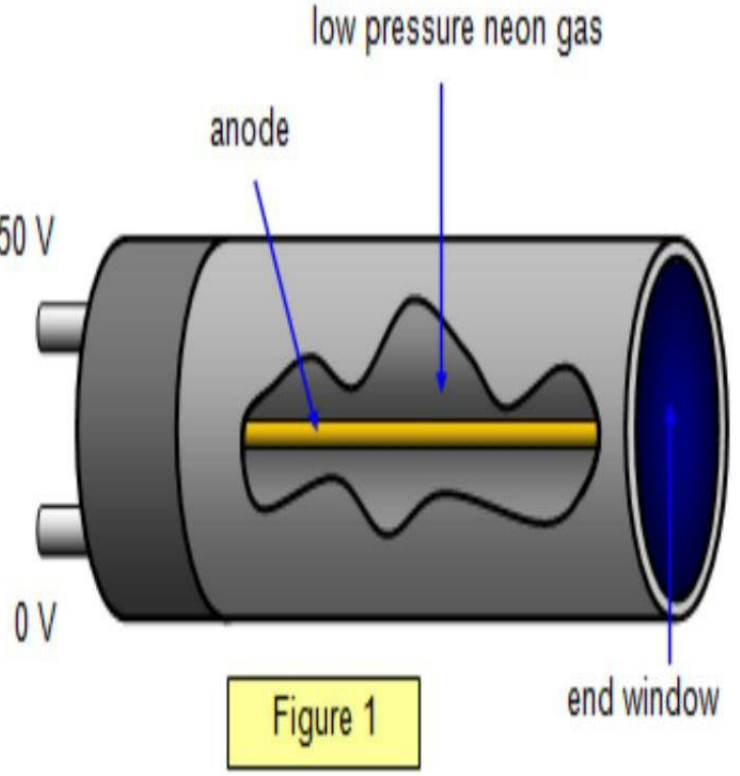


Figure 1

Pancake tube type:

The pancake tube is a variant of the end window tube

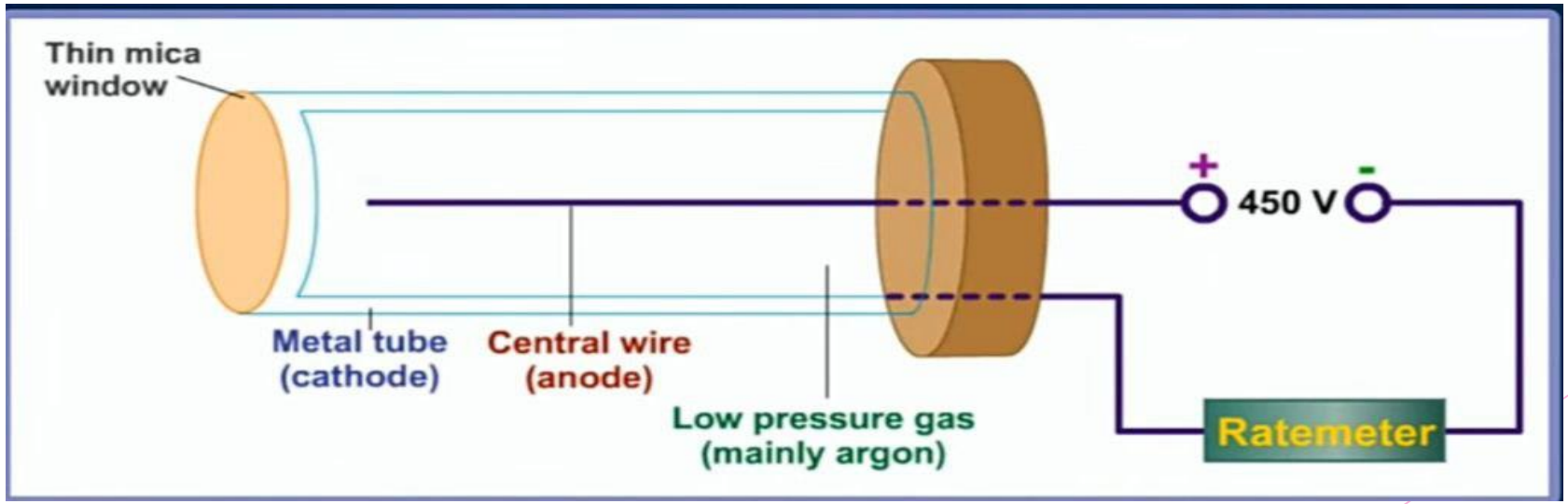
, but which is designed for use for beta and gamma

contamination monitoring. It has roughly the same sensitivity to particles as the end window type, but has a flat annular shape so the largest window area can be utilized with a minimum of gas space

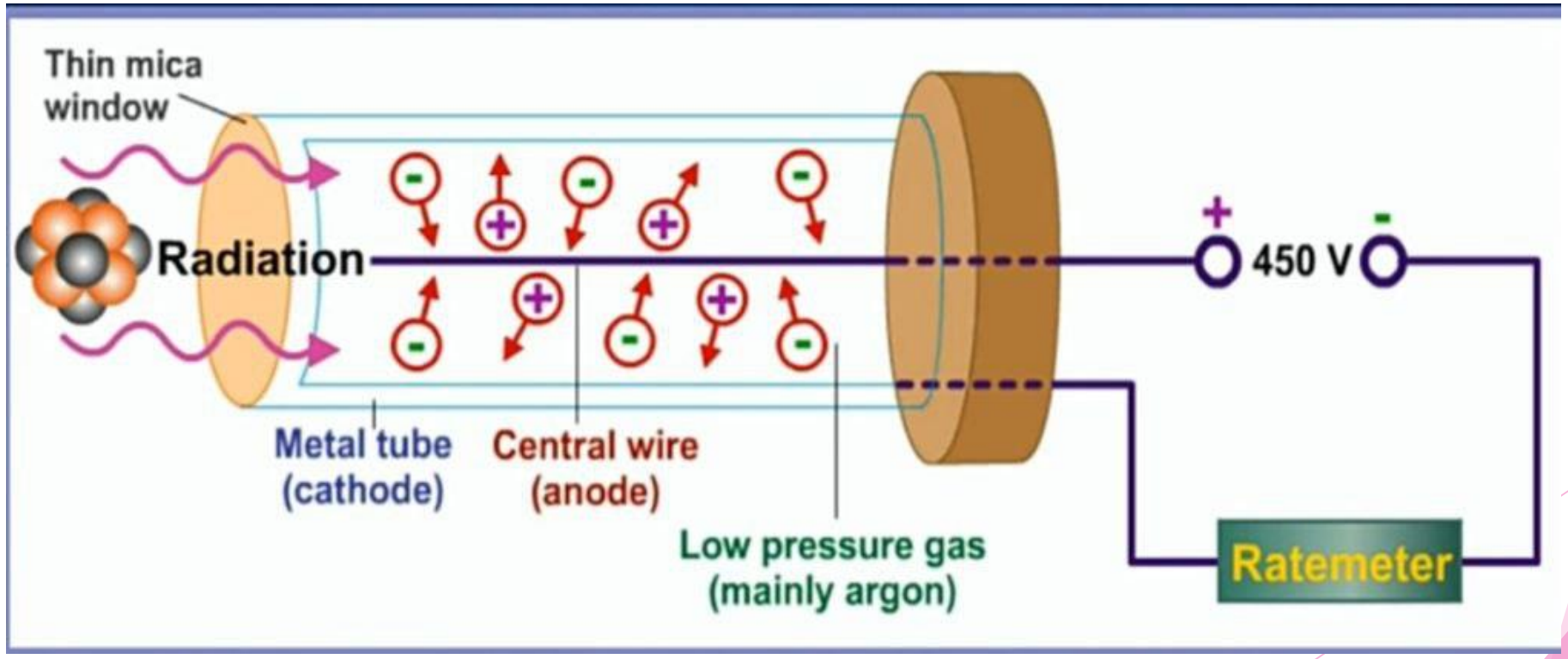


Principle of operation

- 1. When a single gamma or beta ray entering the tube, a small amount of ionization is produced.
- 2. The center electrode which is at high positive potential attracts the electrons and gives them energy to produce further ionization until the whole volume contains ion pairs.



- 3. The electrons are rapidly collected.
- 4. The voltage on the center electrode drops and the slow positive ions go to the outer wall.
- 5. After 400microsecond (Dead time) the tube is ready to repeat the Process.



Application

- To detect or estimate radioactivity in a tissue or organ in situ
- To detect radioactive emission from a biological sample
- To estimate or detect radioisotope in metabolites

ADVANTAGES:

- They are relatively inexpensive.
- They can detect all types of radiation

DISADVANTAGES:

- They cannot determine the exact energy of detected radiation.
- They have a very low efficiency.