

RADIOGRAPHY

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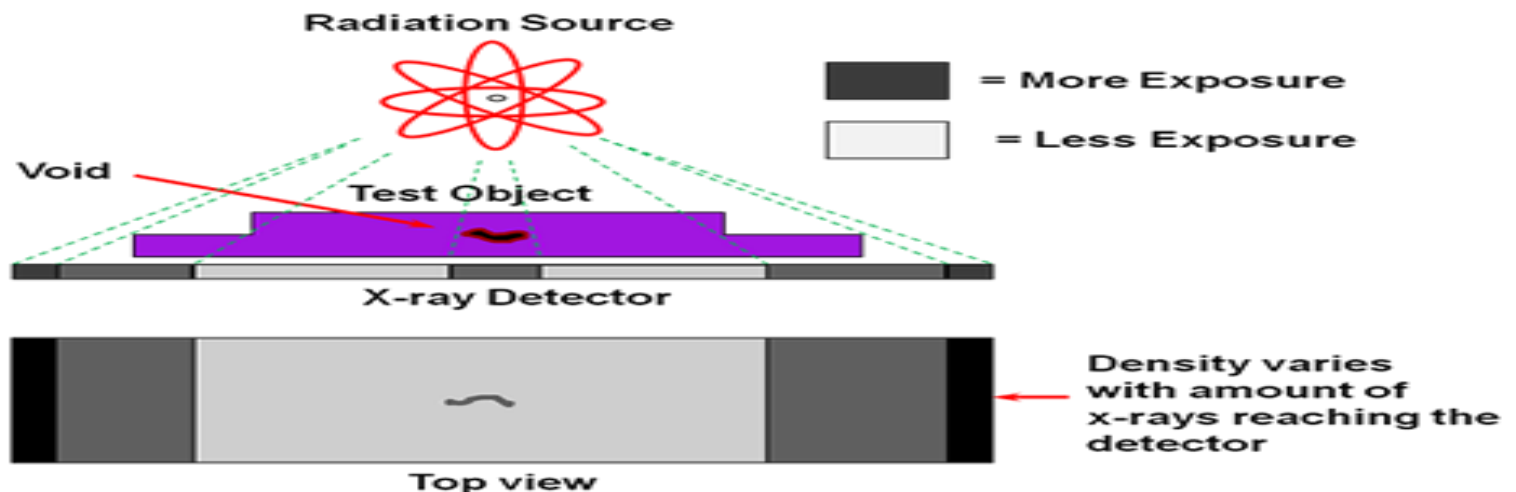
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INTRODUCTION

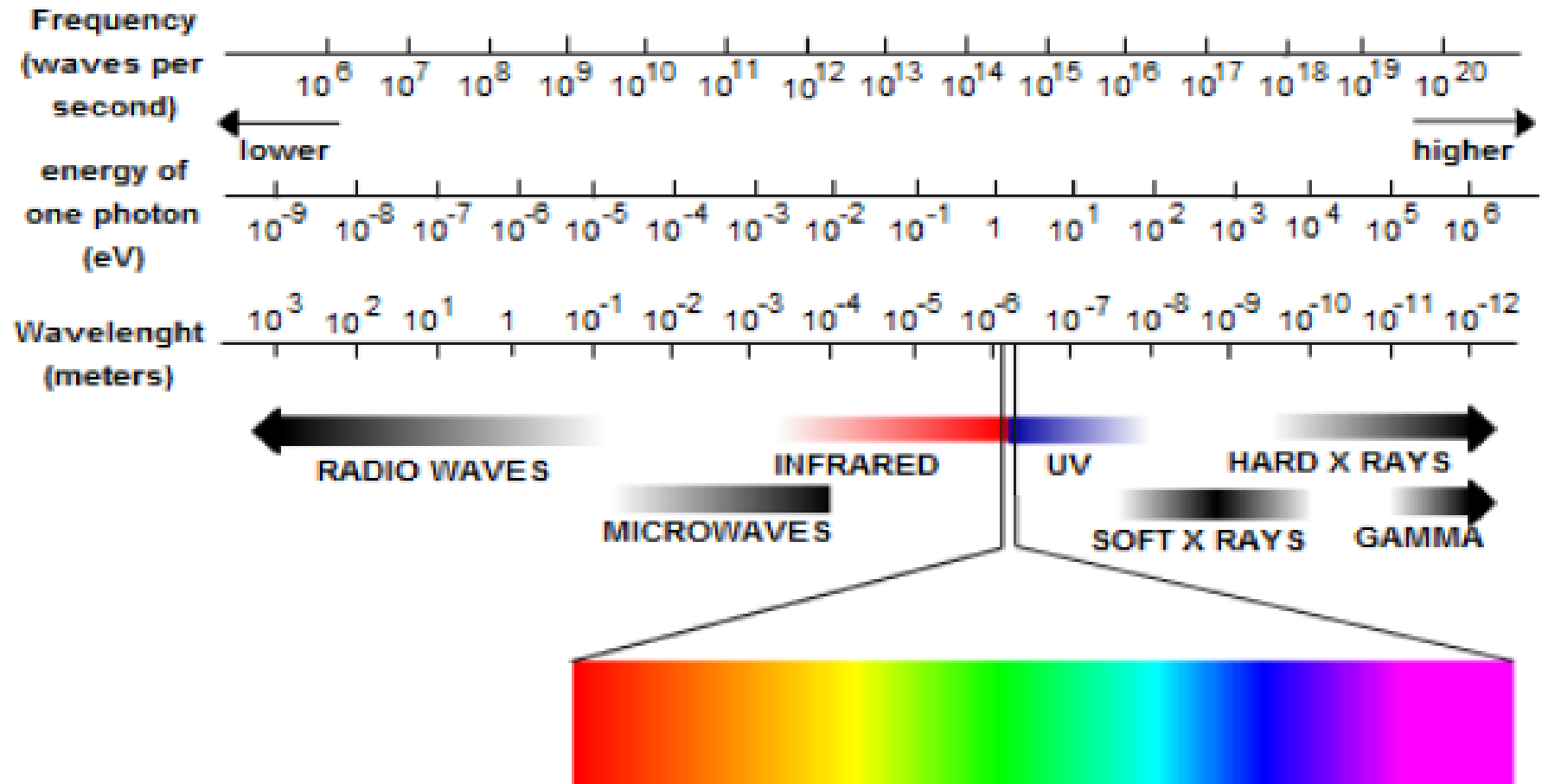
- Radiography is used in a very wide range of applications including medicines, engineering, forensic, security etc.
- In NDT, radiography is one of the most important and widely used methods.
- This technique involves the use of penetrating gamma or X-ray radiation to examine parts and products for imperfections.

BASIC PRINCIPLE

- In radiographic testing, the part to be tested is placed between radiation source and a piece of radiation sensitive film
- An X-ray machine or radioactive isotope is used as a source of radiation. Radiation is directed through a part and onto film or other media



Electromagnetic spectrum

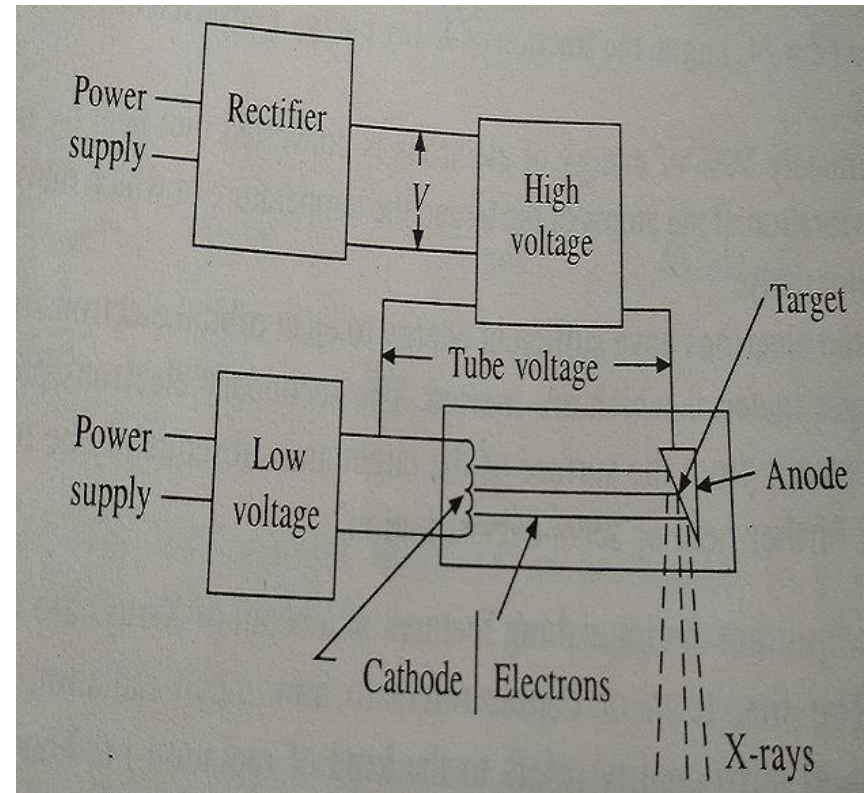
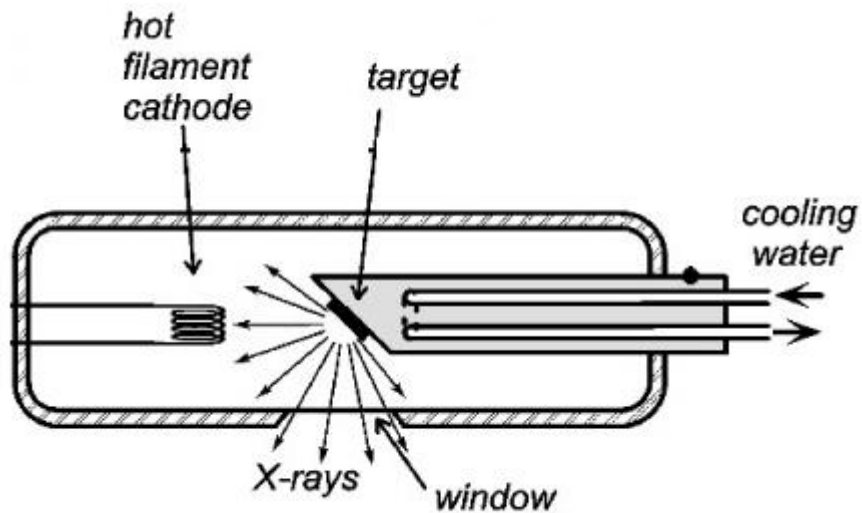


The Electromagnetic Spectrum

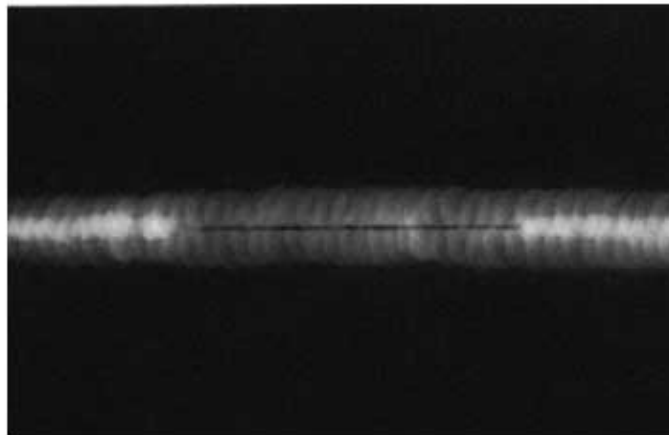
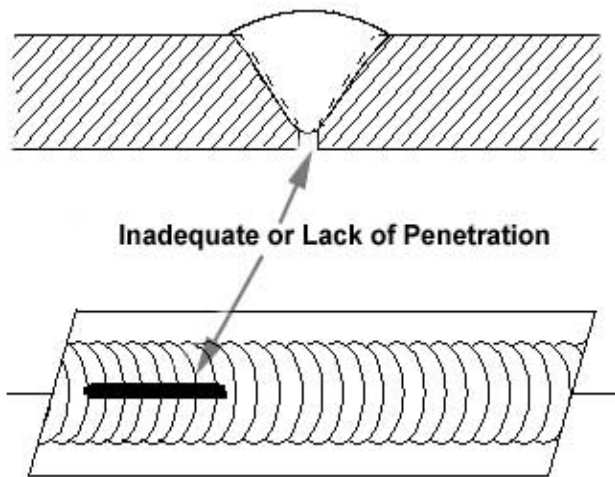
Properties of X-ray and gamma ray

- They are not detected by human senses.
- They travel in straight line with a speed of light.
- Their path cannot be changed by any electrical or magnetic fields.
- They can be diffracted to a small degrees at interfaces between two materials.
- They can pass through matter because of their high energy levels.
- The degree of penetration will depend on their energy and the material they are going through.
- They have enough energy to ionize matter and can damage or destroy living cells.

Generation of x-rays

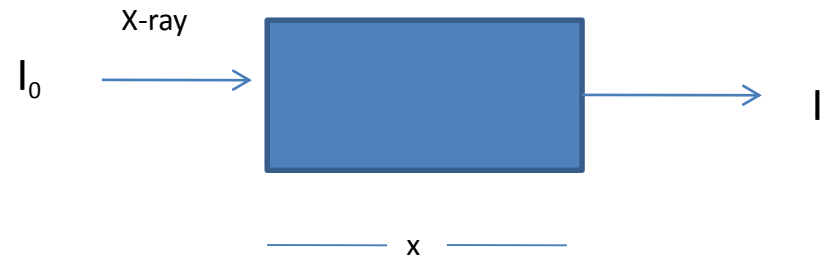


X-ray films



Radiation absorption

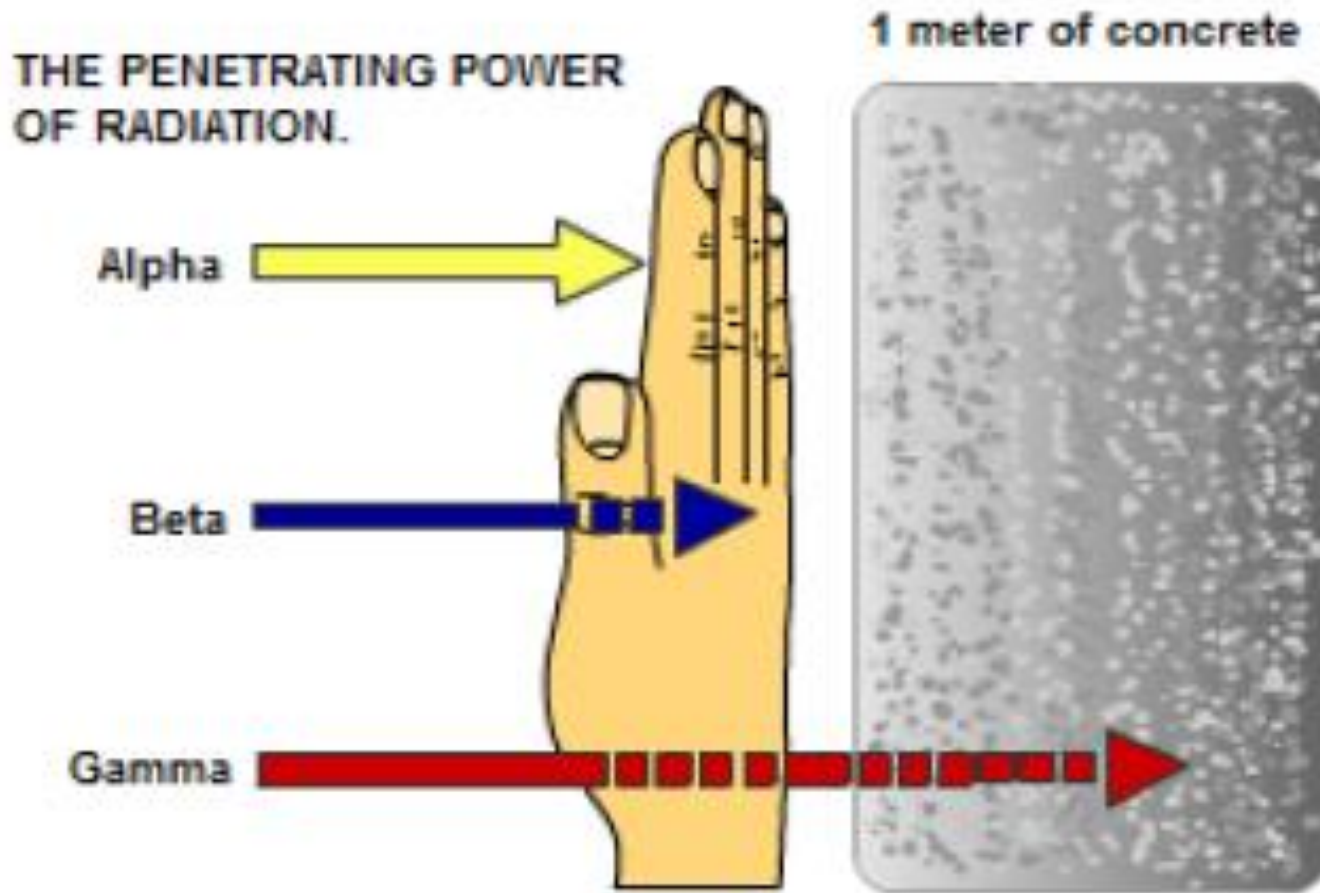
- $I = I_0 e^{-\mu x}$
- μ is the linear absorption coefficient
- I_0 being initial intensity (unattenuated intensity).
- X is the distance travelled through the matter.
- $I = I_0 e^{-(\mu/\rho) \rho x}$
- $I = I_0 e^{-m \rho x}$
- $\mu/\rho = m$ is the mass absorption coefficient



Interaction of x-ray and matter

- Why attenuation of x-rays?
 - Interact with atoms
 - Can be absorbed or scattered
 - Transmission

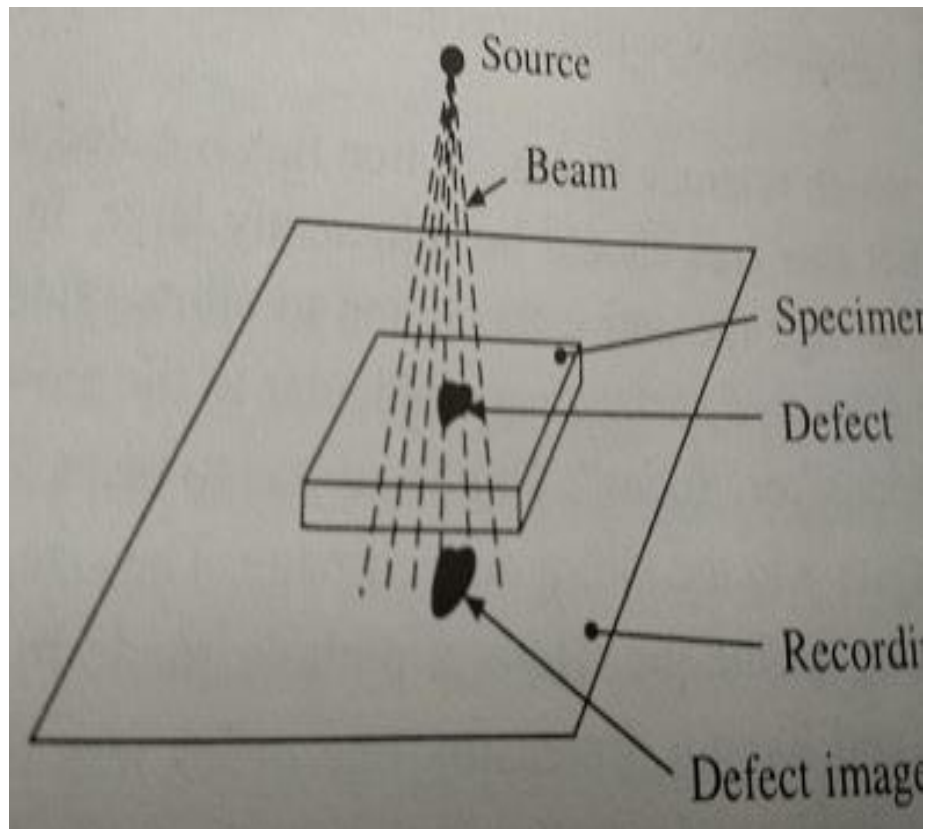
Penetrating power of radiation



Absorption

- Photoelectric Scattering
- Compton scattering
- Pair production
- Thomson scattering

Image formation



Advantages

- Both surface and internal discontinuities can be detected.
- Significant variation in composition can be detected.
- It has very few material limitations.
- Can be used for inspecting hidden areas.
- No preparation is required.
- Permanent test record is obtained.

Disadvantages

- Hazardous to operator and other nearby person.
- High skill and experience is required for exposure and interpretation.
- The equipment is expensive.
- The process is slow.
- Depth of discontinuity is not indicated.
- It requires a two sided access to the component.

Questions

- Explain the working principle of x-ray radiography.
- What are the advantages of gamma ray radiography over x-ray radiography?
- Describe with neat sketch about different layers in x-ray films.
- Explain the geometric unsharpness in radiographic inspection.