

# Screen-Film Radiography



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# *Introduction*

Radiography is the making of images by means of “X-RAYS”

Light sensitive materials are used in Radiography

Image exists as a Hidden one within the materials used.

To bring out the hidden image to visible image,  
Chemical process are needed (Developing & Fixing)

# *Screen-Film Radiography - Components*

- ✓ Medical X-ray Film
- ✓ Intensifying Screen
- ✓ Cassette

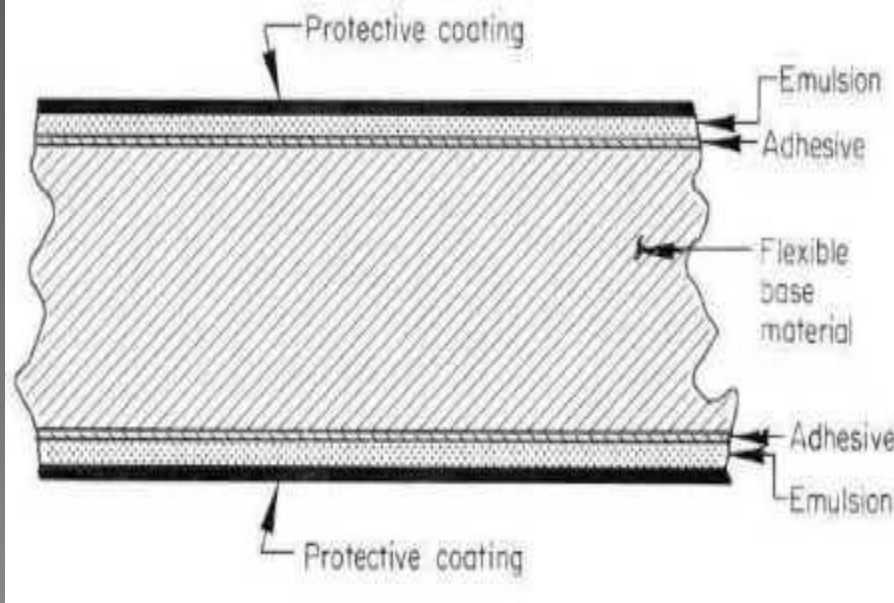
# *Medical X-ray Film & Construction*



Medical X-ray Film is used for capturing, displaying and storing Radiographic images.

Film consists of :

- **Base**
- **Substratum**
- **Emulsion**
- **Top coat**



# *Film Base, Substratum & Top Coat*

## **Film Base**

- ✓ Made of Cellulose triacetate or Polyester.
- ✓ Base should be dimensionally stable to maintain Uniform Image stability during processing and storage.

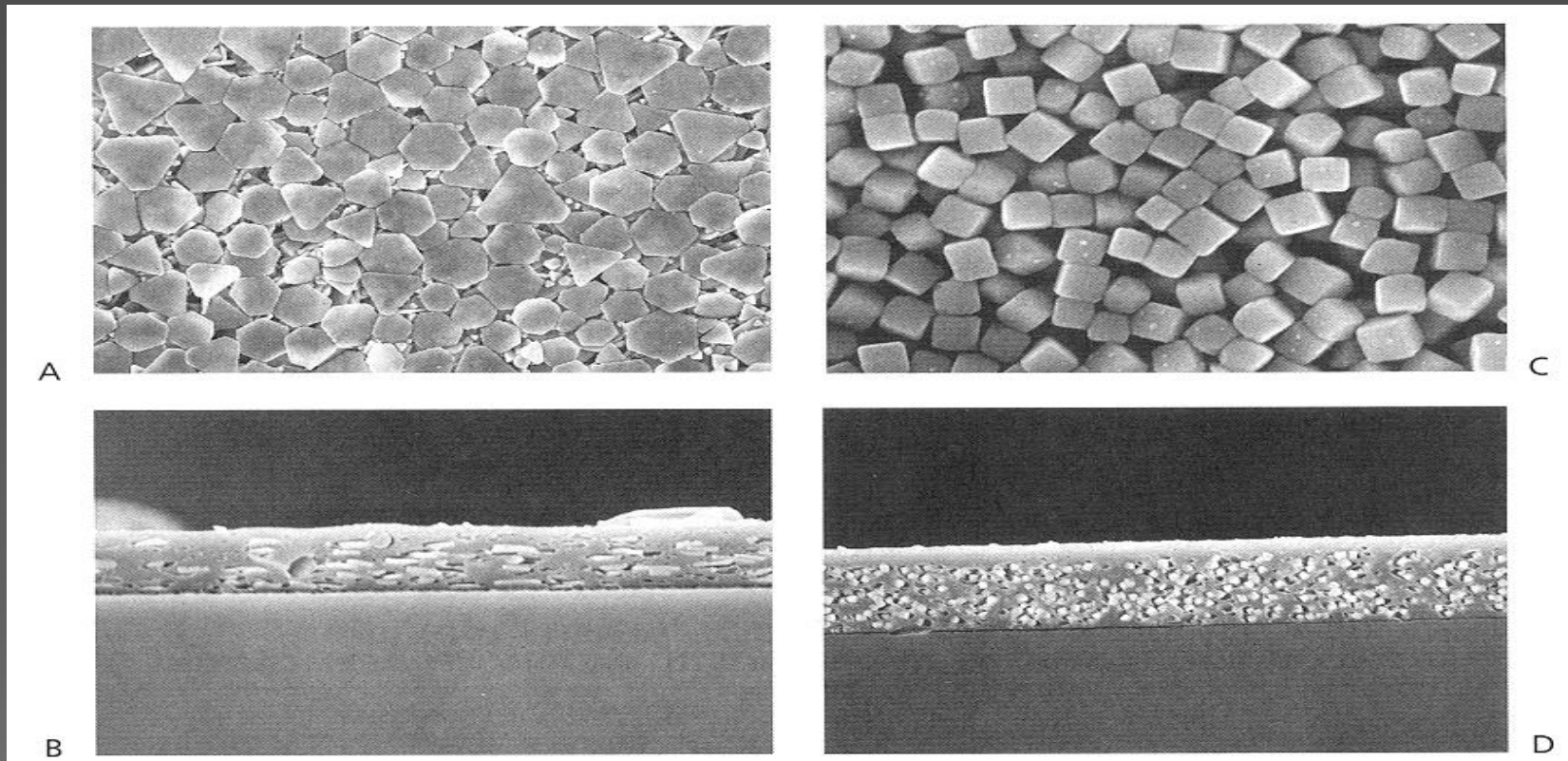
## **Substratum:**

- ✓ Substratum is a Gelatin, containing layer, which binds emulsion layer to the base.

## **Top coat:**

- ✓ Protective Layer of Gelatin applied over the emulsion layer. Protects emulsion from handling damages and abrasion.

# *Film Emulsion*



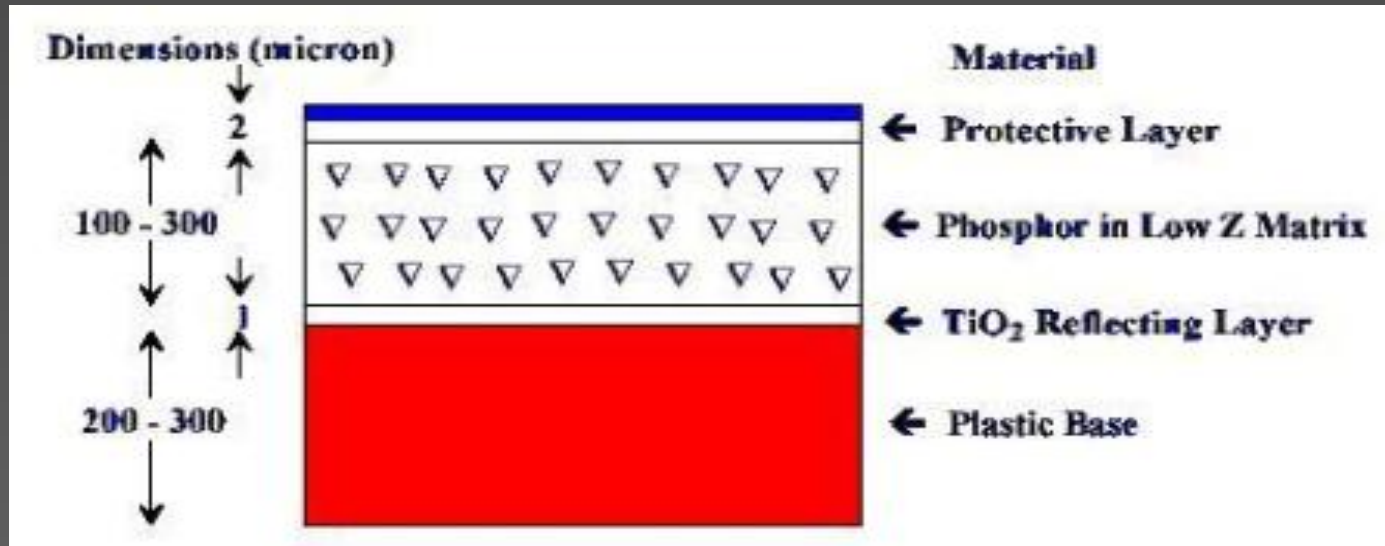
✓Unexposed film consists of one or two layers of film emulsion .

✓Grains of silver halide ( $\text{AgBr}$  and  $\text{AgI}$ ) are bound in a gelatin base and together comprise the film emulsion

# *Intensifying screens*

- ❖ Film by itself can be used to detect x-rays, but they are:
  - ✓ Relatively insensitive & lot of x-ray energy is required to produce a properly exposed x-ray film
  
- ❖ Intensifying screens are used to reduce the x-ray dose to the patient.
  
- ❖ Screens are made of a scintillating material, called a *phosphor*. X-rays interact in the phosphor; visible or ultraviolet light is emitted

# *Intensifying Screen – Cross Section*



✓ *Main function of Screen is conversion of X-rays into Light Photons.*

✓ *Color of Emitted Light photons depends on type of Phosphor used.*

✓ *Commonly used Phosphor are Calcium tungstate, Zinc cadmium sulfide, cesium iodide, barium strontium sulfate.*



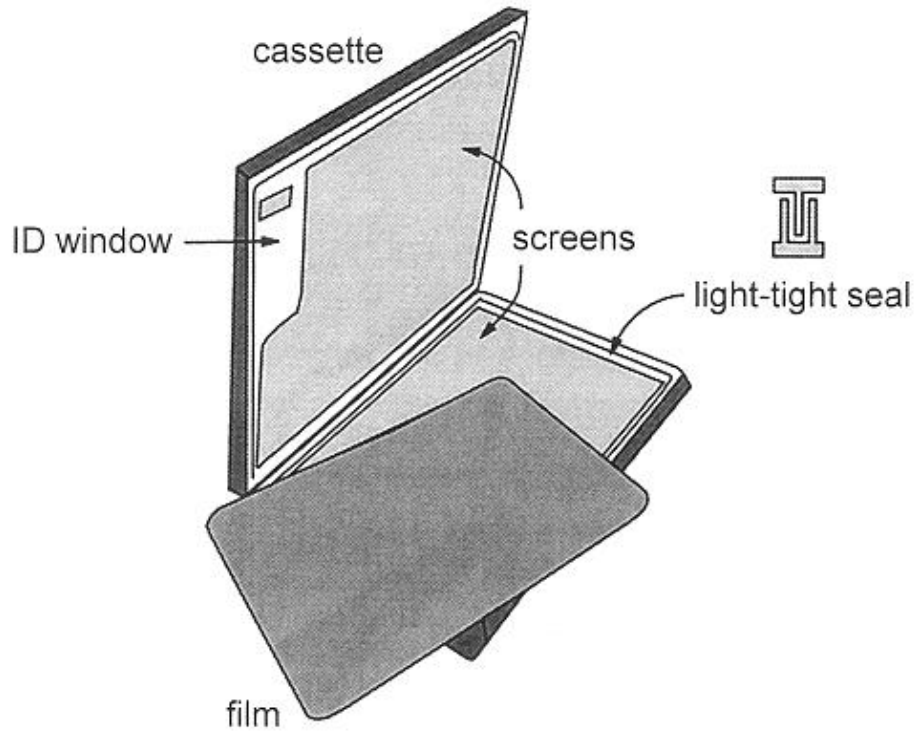
# *Intensifying Screen Function*

- ❑ Absorption Efficiency: Percentage of X-ray photon absorbed in the screen
- ❑ Conversion Efficiency: Number of light photons produced by each absorbed X-ray photon.
- ❑ Intensification Factor: Ratio of X-ray exposure needed to produce a given density on a film without and with Screen.
- ❑ Screen Speed: Speed of Screen is inversely related to exposure ( $1/R$ ) required to produce a given density. Speed increases, exposure decreases.

# *Fast screen and Slow Screen*

<b>Fast Screen</b>	<b>Slow Screen</b>
Thicker Screen	Thin Screen
Less Spatial Resolution	Better Spatial Resolution
Less Patient Exposure	High Patient Exposure
Usually Green Light emission	Usually Blue Light Emission
Gadolinium oxysulfide	Calcium Tungstate

# *Cassette*



*Cassette is a Light Proof rigid holder that contains the screen and film.*

*Parts:*

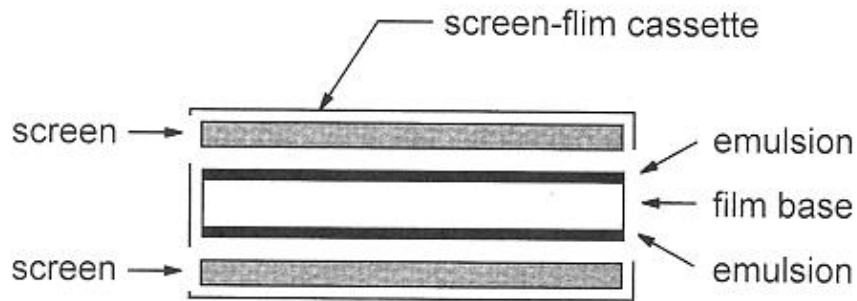
*✓ Front side*

*✓ Back side*

*✓ Screens*

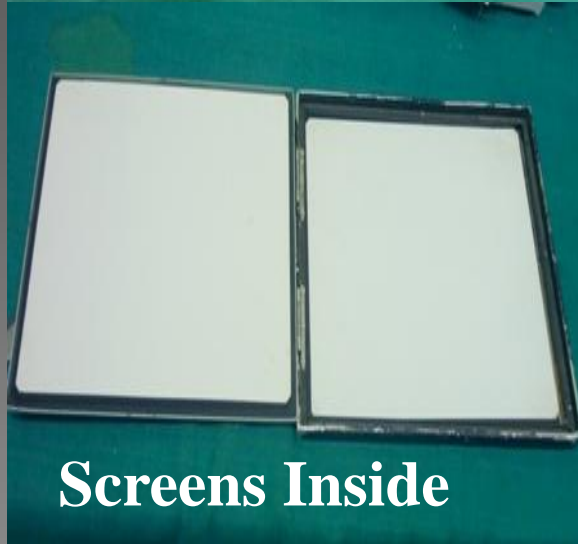
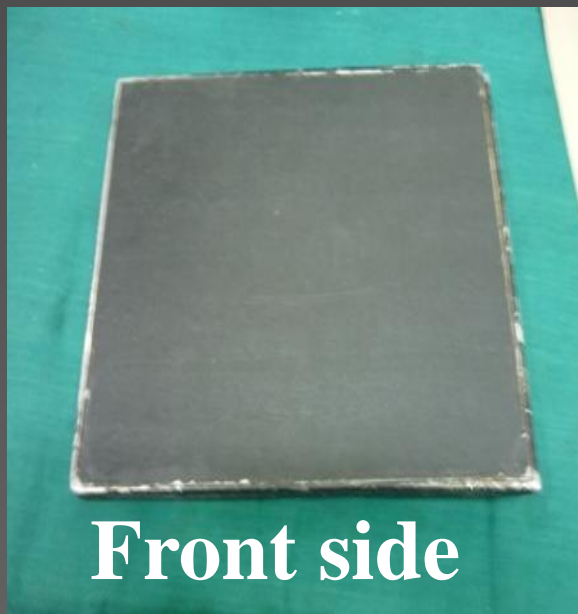
*✓ Compressive Material*

A



B

# Cassette Parts



## *Cassette Cont....*

- ✓ Front side of cassette is made of Low-atomic number material like Plastic.
- ✓ Back Side is made of Lead or high atomic number material .
- ✓ Usually 2 intensifying screens (front and back) are used, in combination for double emulsion film
- ✓ Compressive material, usually rubber or felt kept between Screen and cassette cover to maintain good screen-film contact.
- ✓ Film is loaded between the two Screens.
- ✓ Cassette may be of hinge type or button type to load & unload films.

# *How X-ray Images are formed*

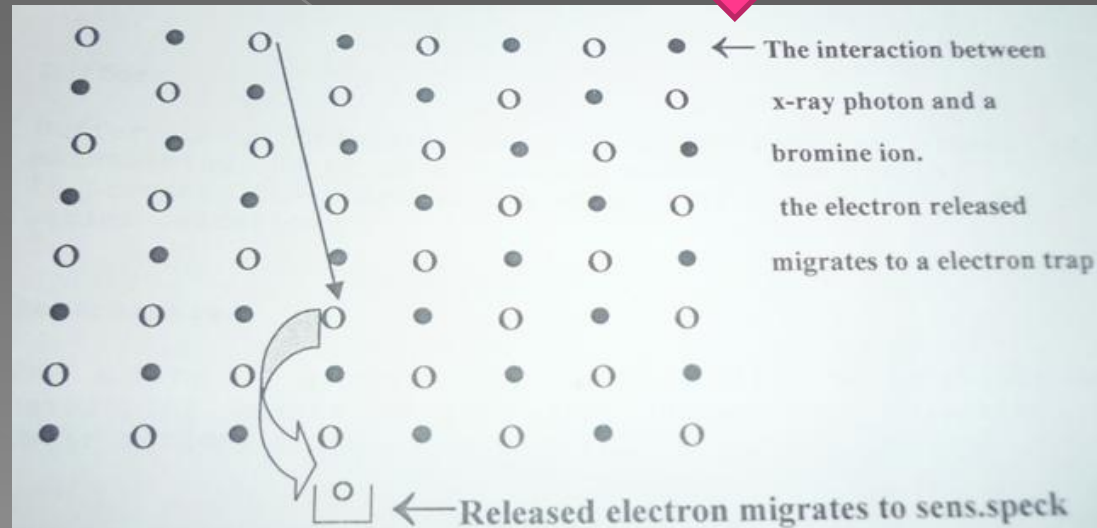
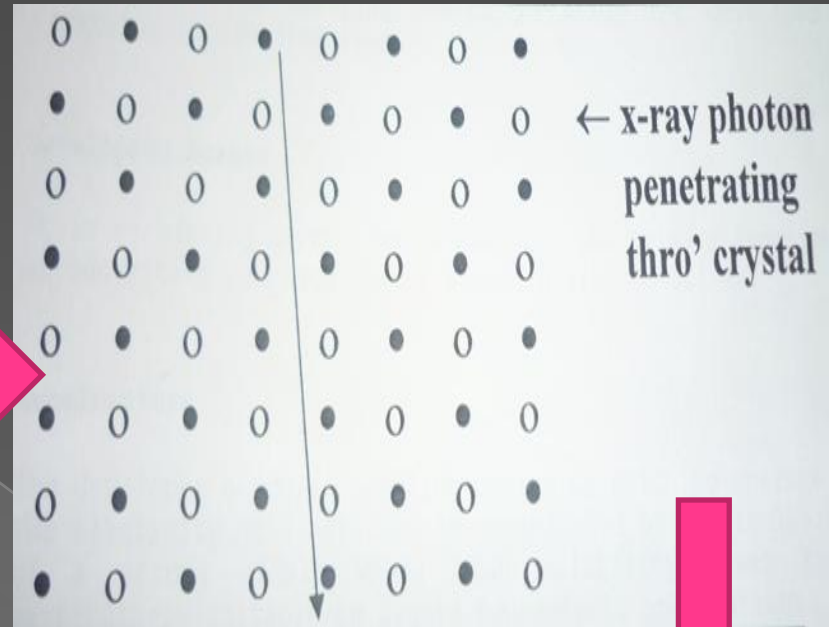
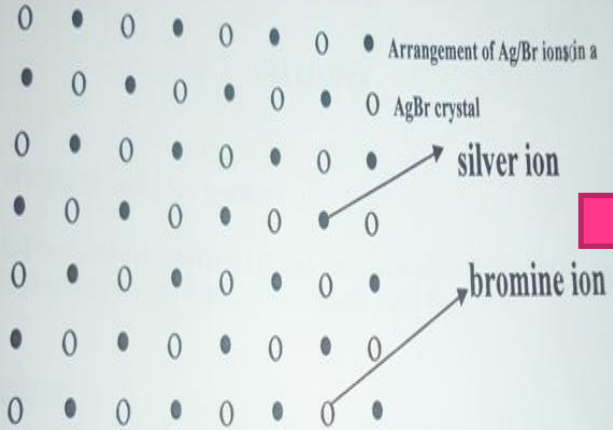
- ✓ When X-ray photons [or light photons] strike the silver bromide crystals in the emulsion, minute amounts of silver ions are formed on the surface of the crystal, and bromine is liberated and is absorbed by the gelatin.



- ✓ The latent image is formed by deposits of free (ionized) silver ions that cannot be seen. It remains in the emulsion of the X-ray film until it is changed into a visible silver image by chemical processing procedures.

# How X-ray Images are formed ...

## AgBr arrangement



# *Film Processing:*

Development	Converts latent image to black metallic silver
Wash [stop bath]	Removes excess developer.
Fixing & hardening	Dissolves out unexposed silver halide crystals.
Washing (final)	Removes products of processing
Drying	Removes water.



# *Points to be Remembered*

- ❖ Always use correct film-Screen Combination*
- ❖ Never open cassette in open light*
- ❖ Always load and unload film in dark room*
- ❖ Always load correct size film to cassette*
- ❖ Clean and inspect cassette and intensifying screen at regular intervals*
- ❖ Follow Dark Room Techniques for film developing diligently*