SNS COLLEGE OF ALLIED HEALTH SCIENCES

SNS Kalvi Nagar, Coimbatore - 35

Affiliated to Dr MGR Medical University, Chennai

DEPARTMENT OF RADIOGRAPHY AND IMAGING TECHNOLOGY

I YEAR

COURSE NAME : RADIOGRAPHY EQUIPMENTS,MAINTENANCE & QUALITY CONTROL RELATED TO X-RAY ONLY

TOPIC : DIGITAL RADIOGRAPHY

INTRODUCTION

- Digital radiography consists of large area,flat panel,solid state detectors with integrated thin film transistor.TFT readout having fast access with best image quality.
- It should have:
- High spatial resolution
- Contrast resolution
- Dose efficiency

RADIATION EXPOSURE

- Digital radiography likely to reduce radiation exposure to the patients, compared to screen-film systems. This is possible without loss of image quality.
- Reduction of number of retakes is the main cause of dose reduction in DR system.

TYPES OF DIGITAL RADIOGRAPHY

- There are two configuration available in digital radiography:
- Indirect detection flat panel system
- Direct detection flat panel system

INDIRECT DETECTION FLAT PANEL SYSTEMS :

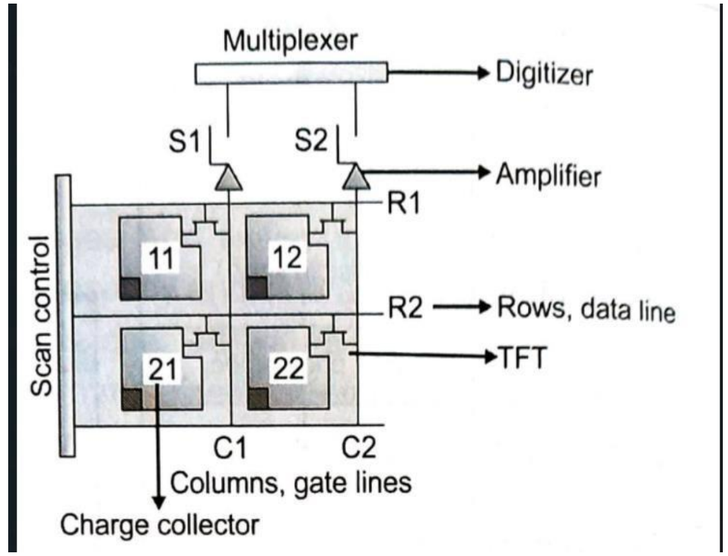
- In indirect systems, the X-rays are converted into light by a phosphor and then light is converted into electric signal.

DIRECT DETECTION FLAT PANEL SYSTEMS:

- In direct systems the X-rays are converted directly into an electric signal

INDIRECT DETECTION FLAT PANEL SYSTEMS

- It consists of **scintillation phosphor, amorphous silicon photo diode(a-Si) and flat TFT** array.
- Two type of phosphor materials are commonly used namely,
  - **Gd_2O_2S:Tb**
  - **CsI:Tl**
- The scintillation crystal converts the incident X-rays into light.
- These works similar to intensifying screen as like cassette.
- TFT is basically an electronic switch that can be made on and off.
- It has 3 connections namely:Gate, source and drain.



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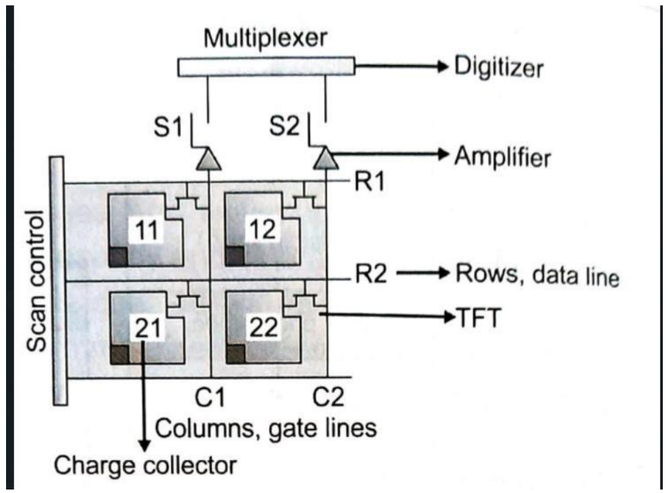
- Source is a capacitor.
- Drain is connected to the read out line(vertical column).
- Gate is connected to the horizontal line(horizontal row).
- When negative voltage is applied to the gate, the TFT is said to be OFF .
- And if positive voltage is applied to the gate,TFT is said to be ON.
- Charge buildup in each detector element is stored in the capacitor.
- This will connect vertical wires C1, C2, to the digitizer through switches
- S1, and S2.The multiplexer select the column sequentially and the charge is amplified and allowed to move to the digitizer.
- Finally , the signal is digitized and stored for image analysis.



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- Initially, the capacitor of each detector element that stores the charge is earthed, so that all the residual charges are passed on to the ground.

- When exposed to X-rays, the scintillation emits visible light, which in turn exposes the light sensitive photo diode (a-Si).

- The photodiode release electrons, so that charge build up in each detector element, which is stored by the capacitor.

- Later, the charge in each detector element is read out by the electronics

Cont.,

- During the X-ray exposure, negative voltage is applied to the gate and all the transistor switches are in OFF position.
- The charge accumulated in each detector element is stored in the capacitor.
- During the read out process, positive voltage is applied to the gate, one row at a time.
- Thus, the switches of detector elements in a given row are made ON.
- This will connect vertical wires C1, C2, to the digitizer through switches S1, and S2.
- The multiplexer select the column sequentially (one column at a time) and the charge is amplified and allowed to move to the digitizer.
- Thus, the gate selects a row and multiplexer selects a column and the charge in each detector element is read out sequentially.
- Finally, the signal is digitized and stored for image analysis.

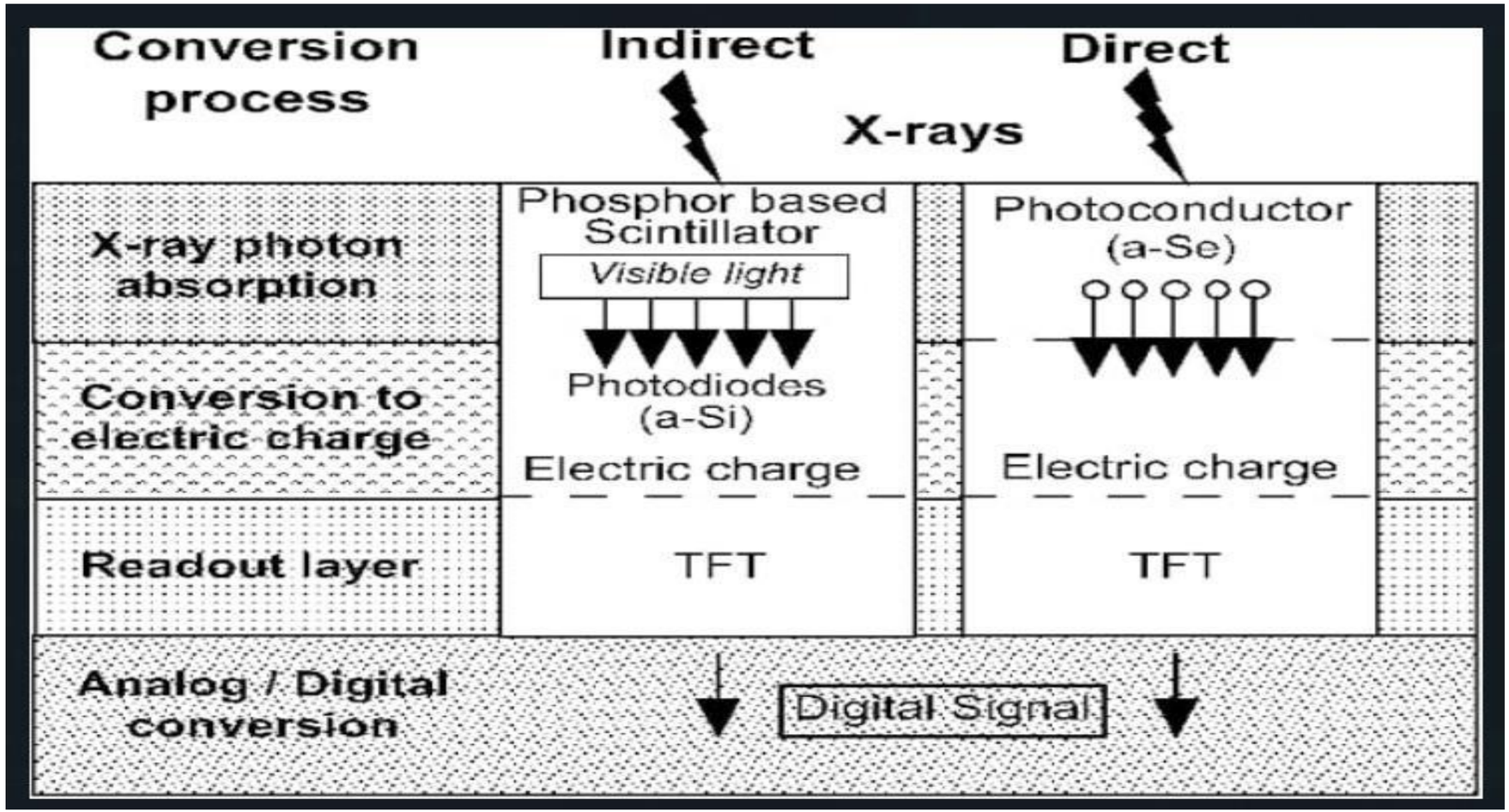
ASSESSMENT

- What is the function of photo diode?
- What is the scintillation material and mention the name of the photo diode?
- What is the difference between indirect and direct digital radiography?
- What is TFT and its function?

DIRECT DETECTION FLAT PANEL SYSTEM

- Photo-conductor material like **amorphous selenium** which directly converts x-rays into electrical signal.
- No intermediate material like scintillation phosphor.
- The electrical signal is proportional to the intensity of x-rays.
- When selenium is exposed to X-rays, it emit electrons,which discharge part of the applied voltage.
- The amount of discharge is proportional to the radiation intensity, resulting in latent charge image.
- These charges are stored in the capacitor and the pattern of charge is readout by scan control lines,similar to that of indirect systems.
- Finally the the signal is amplified,digitized for image analysis.

COMPARISON OF INDIRECT AND DIRECT SYSTEM



ASSESSMENT

- ❑ Mention photoconductor material used in direct digital radiography.
- ❑ Define image receptor.
- ❑ What is the direct and indirect digital radiography?
- ❑ Difference between CR and DR

REFERENCE

- The Physics of Radiology and Imaging by K Thayalan


THANK
YOU