

# ***OPTICAL MICROSCOPY***

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# We will talk about;

- *What is a microscope?*
- *What is an optical microscope?*
- *How does it work?*
- *Usage areas*



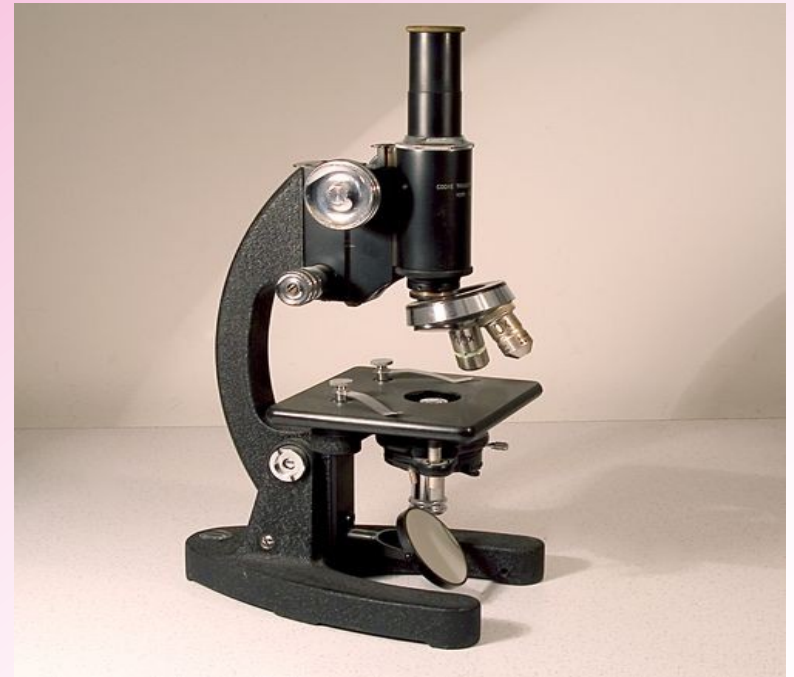
# Outline

- *Microscope*
- *Optical microscope*
- *Parts of optical microscope*
- *How does it work?*
- *Usage areas*
- *Advantages & Disadvantages*

*A microscope is an instrument to see small objects with naked eye.*

*Optical microscope; is a type of microscope which uses visible light and a system of lenses to magnify images of small samples.*

*There are two basic configurations of the conventional optical microscope in use, the simple (one lens) and the compound (many lenses).*



# Optical Microscopes

- *Optical microscopes are the oldest microscopes.*
- *Optical microscopes are the simplest and most used types.*
- *Optical microscopes use visible wavelengths of light.*

# HISTORY OF OPTICAL MICROSCOPES

- *Middle of the 15th centuries, one lens is used.*
- *Hans and Zacharias Janssen in 1600, in Holland. They realized that couple of lenses zoom objects while he was manufacturing glasses.*
- *(1632-1723) Anton van Leeuwenhoek. He created microscope which zooms object 270 times and he started to research the bacteria.*

# Basic Components



- **Eyepiece Lens:** *the lens at the top that you look through.*
- **Tube:** *Connects the eyepiece to the objective lenses*
- **Objective Lenses:** *Usually you will find 3 or 4 objective lenses on a microscope. They almost always consist of 4X, 10X, 40X and 100X powers.*
- **Rack Stop:** *This is an adjustment that determines how close the objective lens can get to the slide.*
- **Condenser Lens:** *The purpose of the condenser lens is to focus the light onto the specimen.*





- **Stage:** *The flat platform where you place your slides. Stage clips hold the slides in place.*
- **Revolving Nosepiece or Turret:** *This is the part that holds two or more objective lenses and can be rotated to easily change power.*
- **Illuminator:** *A steady light source (110 volts) used in place of a mirror. If your microscope has a mirror, it is used to reflect light from an external light source.*
- **Arm:** *Supports the tube and connects it to the base*
- **Base:** *The bottom of the microscope, used for support*

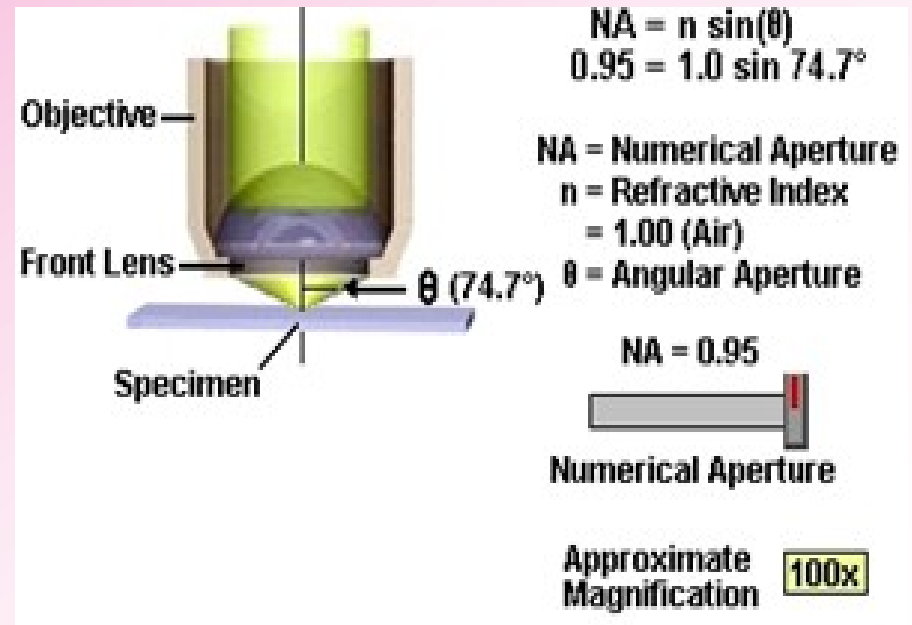
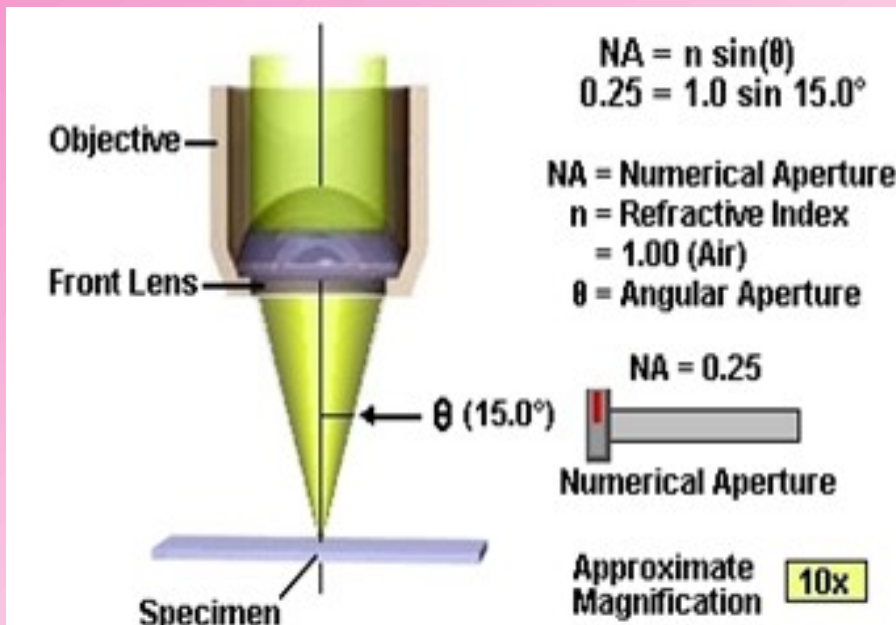
# ~Optic of microscope~

*Objective spaces;*

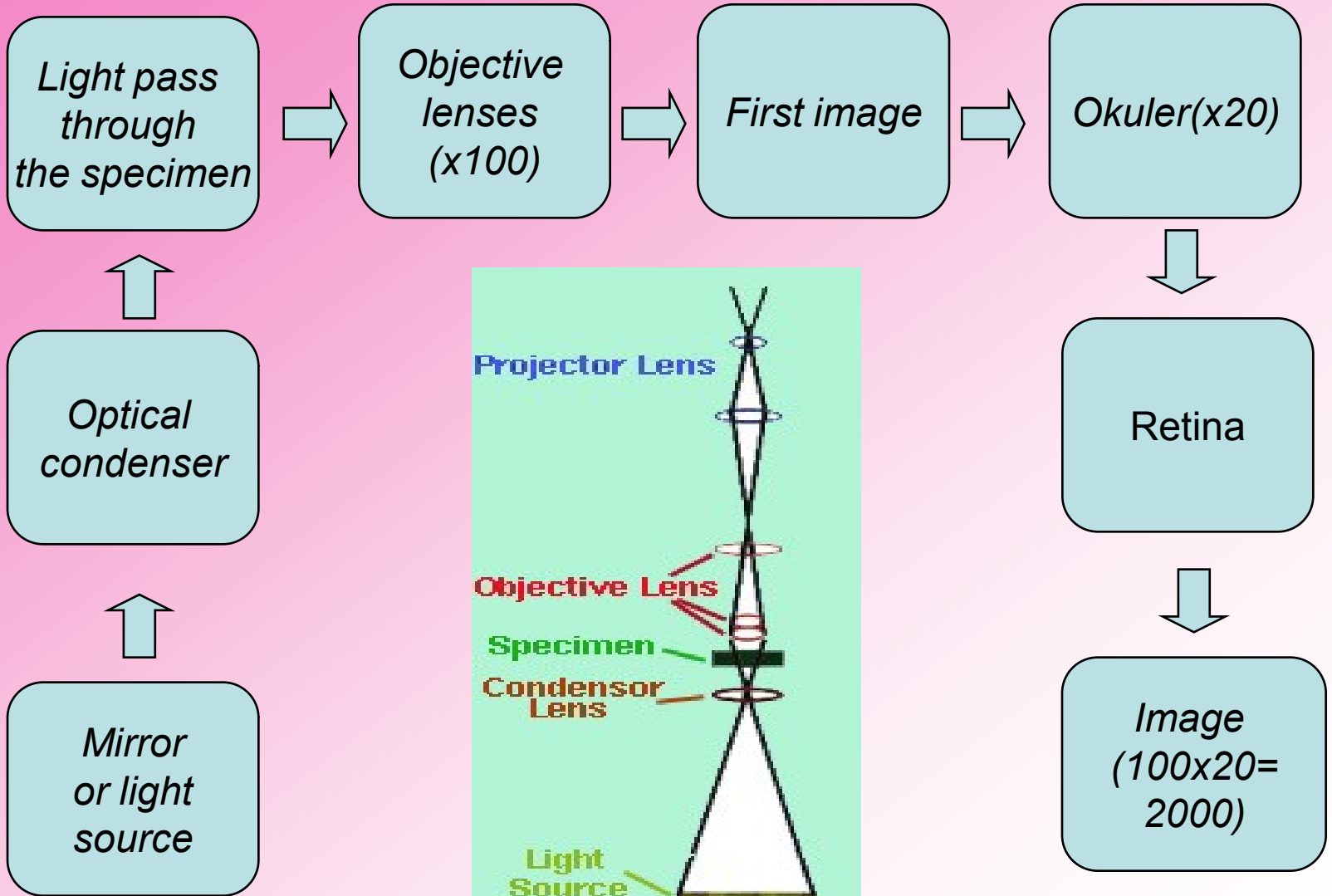
$$NA = n \sin U$$

$n \gg$  refractive index (hopefully; 1)

$U \gg$  1/2 of the light of the angle that coming over the objective



# HOW IT WORKS ??



## *We can analyse with optical microscope*

- *Grain Boundaries*
- *Phase boundaries*
- *Microstructure*
- *Lunkers*

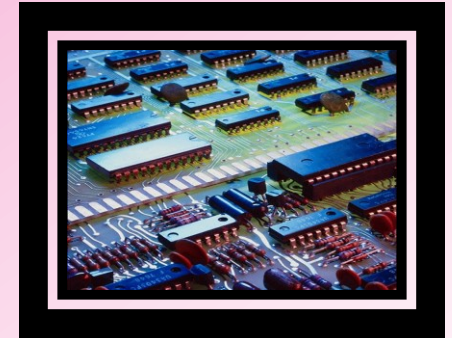
### *Some materials that can be determined in optical microscope:*

- *carbides in steels.*
- *SiC particules in metals such as Ti or Al.*
- *Fiberglasses which glass fiber in epoxy resin.*

# Applications

*Optical microscopy is used extensively in;*

- *Microelectronics*
- *Material Science and Geology*

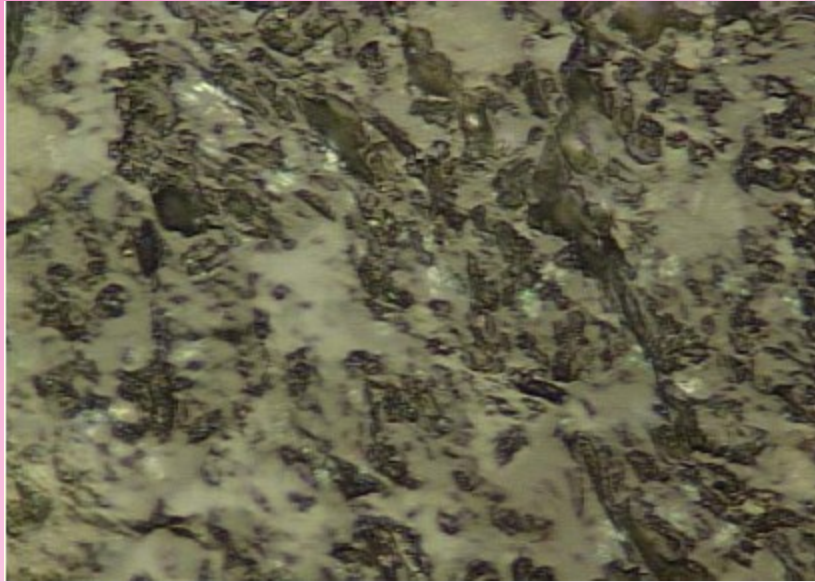


*Non-transparent objects (Ex: metals and alloys)*

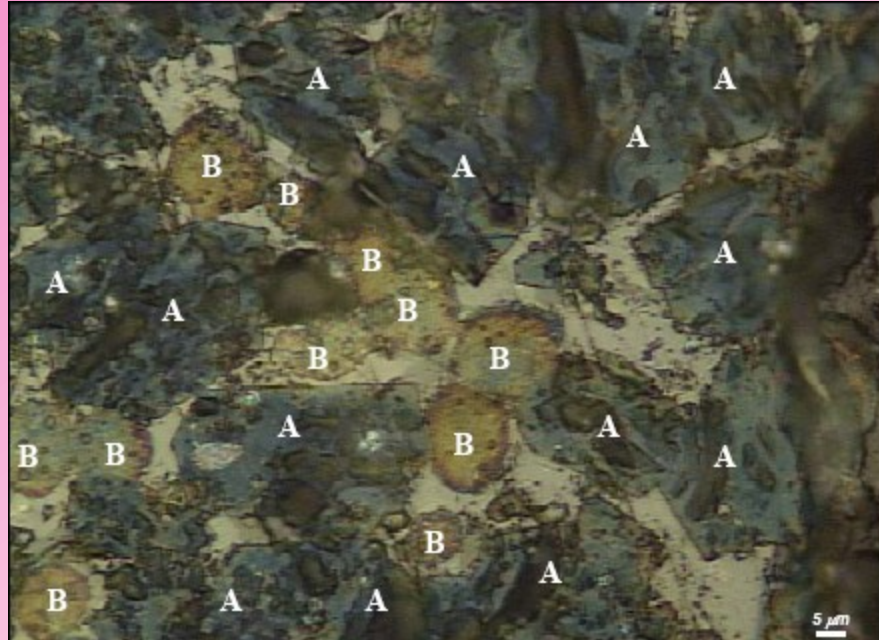
- *Biotechnology (Analyzing transparent object)*
- *Pharmaceutical Research*
- *Microbiology*



# Views of Optical Microscope

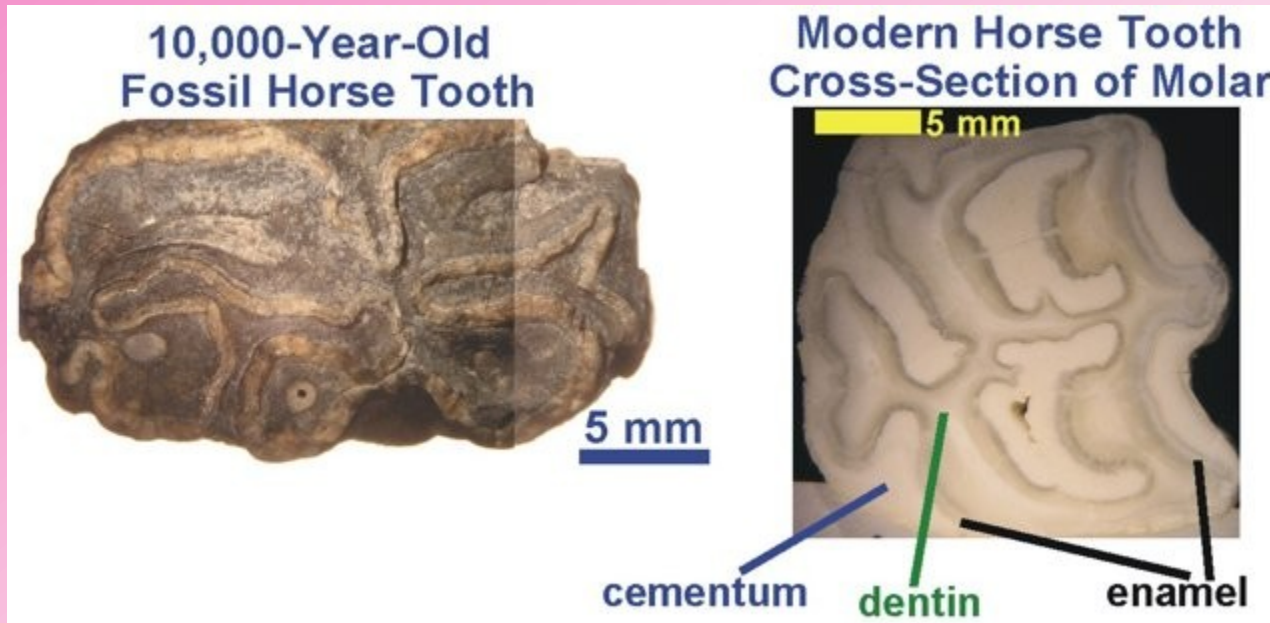


*Clinker of cement (x50)*

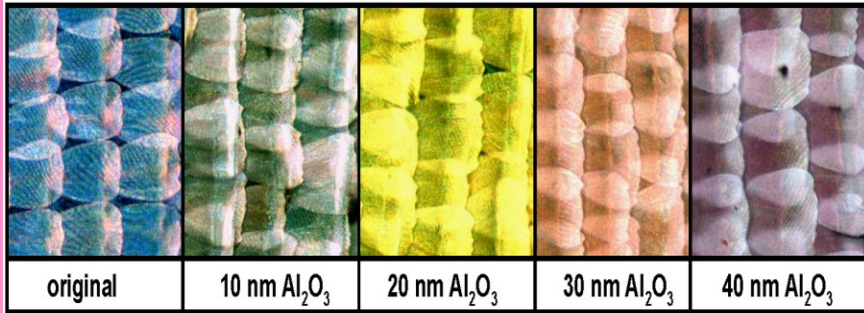


*View of branded clinker with nitric acid (50 times enlarged  
A:Alit crystals, B:Belit crystals)*

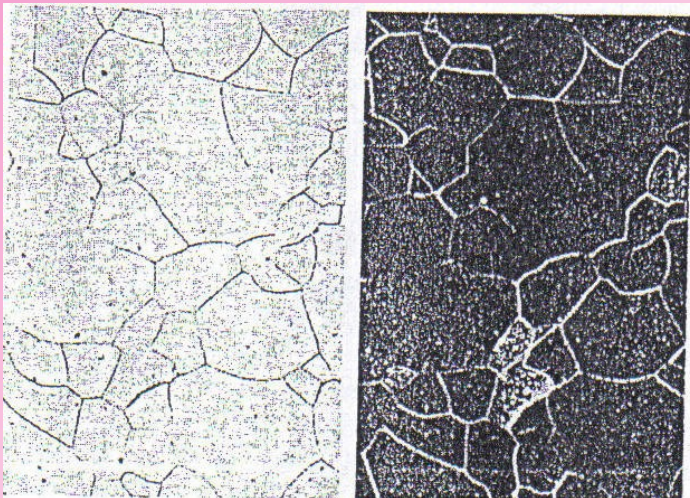
*From Professor Pasteris' research*







*view of Al<sub>2</sub>O<sub>3</sub>*



# Advantages & Disadvantages

- *Optical microscopes can enlarge only times of 1000, because of using light.*
- *Optical microscopes are not able to display details that smaller than 250 nm which is the half wave length of the light.*
- *On the light ways air is an acceptable thing so living samples can analyse with optical microscope.*
- *In structure analyse generally light reflection is used so optical microscopes are convenient to distinguish some ranges, distributions, shifting bands and basic properties in samples.*

# Summary

- *Optical microscope uses visible light and a system of lenses to magnify images of small samples*
- *It is oldest and simplest microscope.*
- *It's working principle is very simple to understand.*
- *It is easy to use.*
- *Optical microscope has extremely important part in science and technology.*
- *Until these days, optical microscope is developed and some defects are removed by researches.*

# References

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*THANKS FOR YOUR  
ATTENTION...*