Electron Microscopy (EM) Grid

Jyoti Sarita Mohanty

19-05-2018

What is EM grid

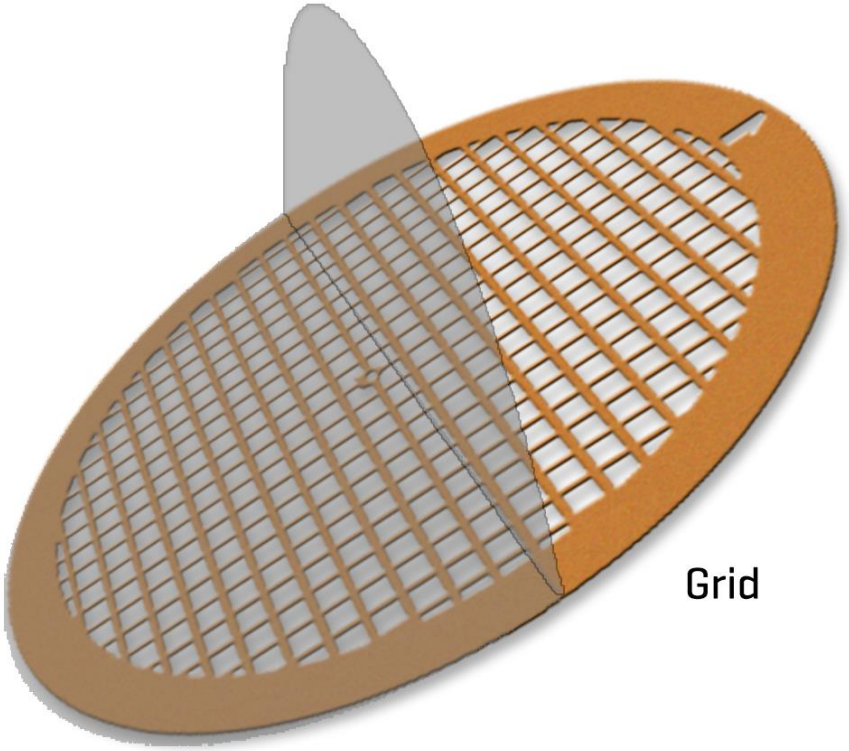
- The EM grid is used in TEM in the similar way as the glass slide is used in light microscope. It provides a way for supporting the specimen and delivering the specimen into the TEM column for imaging.

- The EM grid is a thin-foil mesh having diameter of 3.05 mm and it can be made from a number of different metals (copper, gold, nickel, molybdenum, stainless steel, tungsten, aluminium, titanium etc.), and have various spacing patterns.

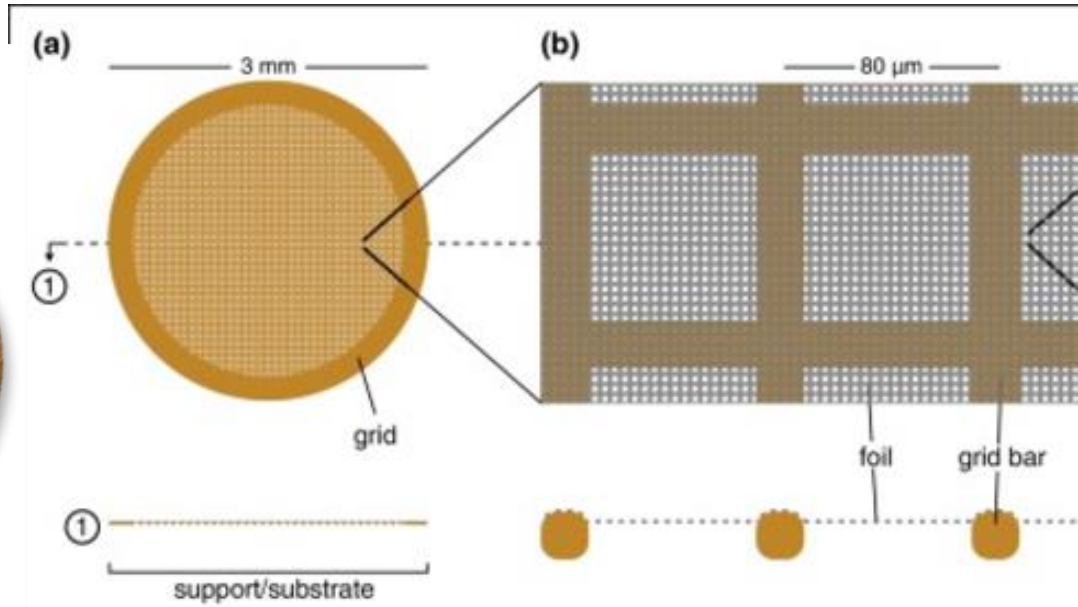
- The diameter of grids is standard, as 3.05 mm. The Thickness is variable based on the materials of the grid. The thickness range is from 10 μm to 25 μm. The mesh of the grid is defined by the number of holes within 1 inch. For example, the 200 mesh grid has 20 holes along diameter direction, 400 mesh grid has 40 holes in diameter.

- Since the diameter of grid is a standard length, 3.05 mm, each hole size is less than 200 μm in 100 mesh grid, 100 μm in 200 mesh grid, 75 μm in 300 mesh grid and 50 μm in 400 mesh grid.

Carbon



Grid



Grid materials	
Copper	**Gold**
Nickel	CuRh
Titanium	Molybdenum
Silicon	Aluminum
	Tungsten

Foil materials	
Amorphous carbon	
Gold	
TiSi	SiN
SiO_2	SiC

What we need to do with EM grid before we can use it

➢ Often an electron lucent film is deposited upon the grid to aid in specimen support. The TEM techniques that are often used to investigate macromolecular structures require films made of a thin layer of carbon which may or may not have numerous small perforations. The macromolecules are then examined while adhered to the carbon or while suspended in the holes.

➢ The grids have to be cleaned up for any dirt or chemicals left over from manufacture or process of depositing electron transparent film before putting specimen on it.

- Eliminate any possibility for alternating or damaging the specimen.
- Eliminate or reduce charging problem to get quality data
- Keep pole piece and column clean.

How to chose right grid- some preliminary considerations

- The type of grids and films used are usually determined by the desired specimen preparation technique and sample characteristics.

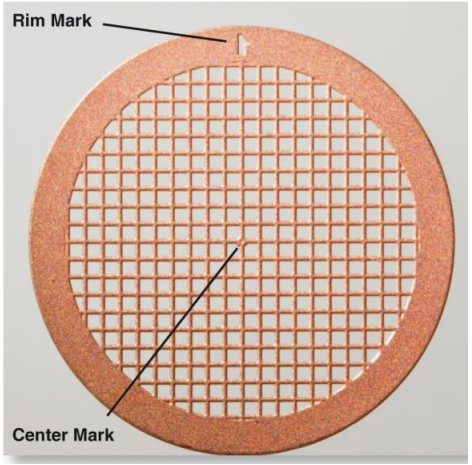
- Copper grids are usually used because they are conductive, stable in the beam and inexpensive. But when treating the sample on the grid with some substances such as acids, bases, some salts, etc. more expensive non-reactive grids such as gold or platinum may be necessary.

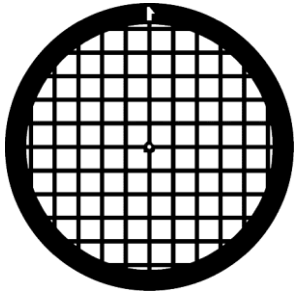
- Both holey films and continuous thin carbon films are mounted on grids with appropriate mesh value for stability in the beam at higher magnifications.

- Non-crystalline amorphous solid samples are best examined when suspended in the holes of a holey carbon film, while negative stained samples are examined on continuous carbon films.

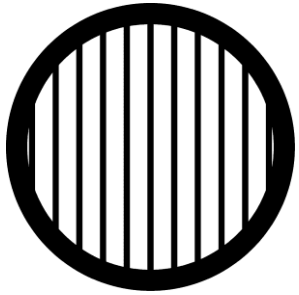
Types of Grids

Marks:
Most of the grid types are available with a center and/or rim mark.
Center mark: Many grids have an asymmetrical center marking, enabling the four quadrants of the grid to be distinguished. Older grids have a 'reverse arrow' center marking to distinguish each half of the grid.
Rim mark: An asymmetrical mark in the rim allows for precise orientation of the grid, and aids in the identification of each side.

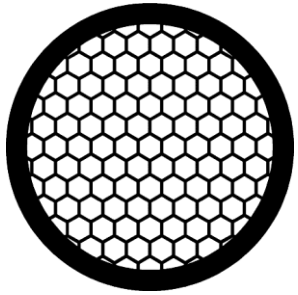




Square Mesh

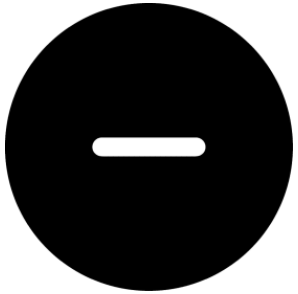


Parallel and Rectangular Mesh Grids



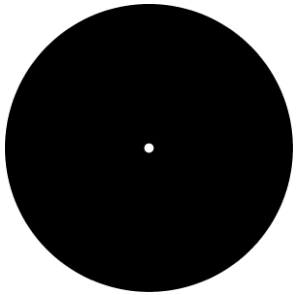
Hexagonal Mesh

The larger the slot dimension the thicker the grid, Molybdenum grids are especially useful in ion milling applications because of its resistance to etching.



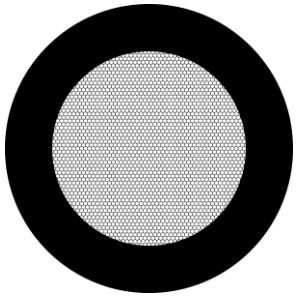
Slot Grids

Consist of one central circular hole. The larger the aperture dimension, the thicker the grid, for maximum rigidity.



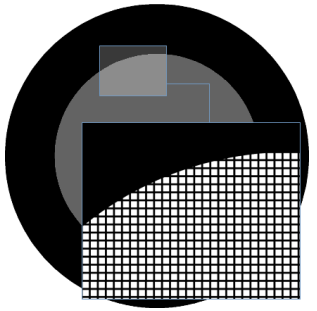
Aperture Grids

Fine Hex Mesh Grids offer a very high transmission value with the additional support of a hexagonal pattern. They offer an alternative to the standard hexagonal mesh grids for use in applications where it is important that the maximum area of specimen is available for viewing in the microscope.



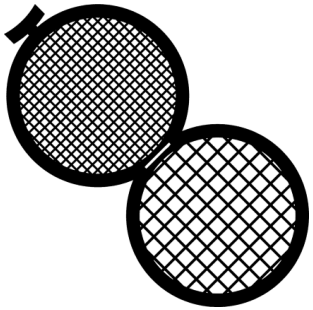
Fine Hex Mesh Grids

Fine Square Mesh Grids have extended the range to offer solutions in applications where it is important that the maximum area of specimen is available for viewing in the microscope.



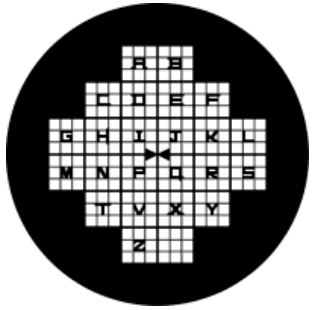
Fine Square Mesh Grids

Double grids, offering a combination of mesh support values, are used primarily in metallurgical applications for supporting thin metal foils. Two grids are joined by a thin 'hinge', allowing one grid to be folded on top of the other, trapping the specimen between them. The grids have a curved securing tab which folds to the curvature of the doubled grid.



Double Folding Grids

The Finder range of grids are useful in applications where specific areas of mesh need to be uniquely identified. These areas range from blocks of 1 to 9 grid cells, and can typically be relocated using an alphabetical and/or numerical code built into the mesh.



Finder, Coordinate, Reference Grids

Grids Cleaning

Why need to clean grid before use

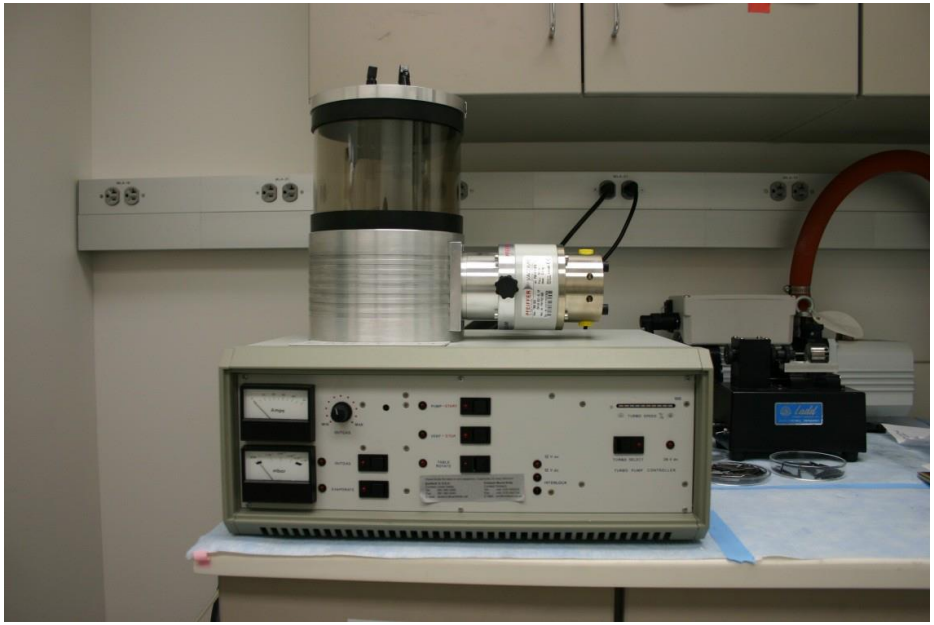
- Good for the specimen
- Good for imaging
- Good for microscope

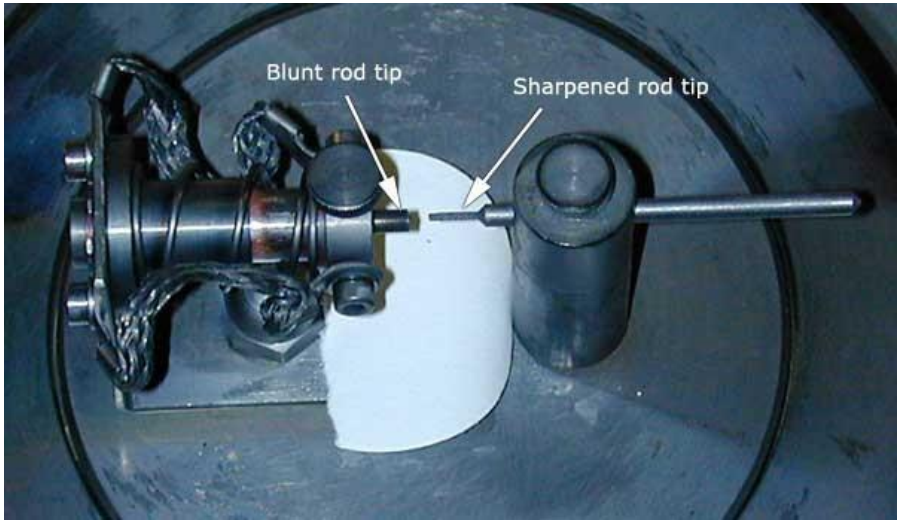
Organic Solvents used for grid cleaning

- Acetone
- ethyl acetate
- chloroform
- ethylenedichloride

Carbon coating and carbon film preparation

- Evaporate a uniform carbon layer over plastic films or freshly cleaved mica to be used as a stand alone support film
- Produce very thin support films (~250Å) for use in testing EM and negative staining





Thank You!