

## SEM Sample stubs, mounts & adapters

### Sample stub introduction

SEM sample stubs or mounts for Scanning Electron Microscopy (SEM) are available in different sizes and formats. They need to be compatible with a specific type or brand of SEM, specimen stage of the SEM and the sample. The three main types of SEM specimen stubs are:

- Pin stubs with a  $\varnothing 3.2\text{mm}$  (1/8") pin
- Cylinder stubs
- Cylinder stubs with M4 threaded hole in the bottom

Less common SEM sample stubs are:

- Cylinder stubs for ISI/ABT/Topcon
- Special sample stubs for special SEM stages such as the Hitachi In-Lens FESEMs, Deben cooling stages, the Gatan 3View system or the Gatan or Polaron cryo stages. They use dedicated sample holders designed for specific applications.

### Pin Stubs with $\varnothing 3.2\text{mm}$ (1/8") pin

The pin stub with a flat top and a pin is the most common specimen stub. The top part which is used to mount the sample can vary from 6 to 100mm (1/4" to 4") in diameter. The pin or stem of the stub is used to secure the SEM sample stub on the SEM stage. The most common sizes are 12.7mm (1/2" and 25.4mm (1") diameter. There are three variations of pin lengths fitting different brands of SEM:

1. Standard pin length of 9.5mm (3/8")
2. Longer pin length of 15mm (0.6")
3. Shorter pin of 6mm (0.23")

#### 1. Standard pin length of 9.5mm (3/8") for FEI, Tescan, etc.

These are the pin stubs which were introduced by Cambridge Instruments in the 70s. They are the most widely used SEM sample stubs. Compatible with SEMs made by FEI, Philips, Tescan, Phenom, Cambridge Instruments, Leica, CamScan, RILEE, Aspex, early model LEO, ETEC, Novascan, Balscan and Siemens Autoscan. The pin stubs are available with sample mounting platforms up to 100mm. For sample preparation on the pin stubs, it is necessary to use sample preparation stands to hold and stabilize the pin stubs. The pin stubs are low cost, readily available, offered in many sizes and there is a wide choice of storage boxes. Based on the pin stub design, there are also special SEM stubs with pre-tilt angles, clips, clamps or vices for special mounting applications.

Note: Most stage adapters for the standard pin accept the shorter pin as well.

#### 2. Longer pin length of 15mm (0.6") for AMRay

The pin stubs with a longer pin length are a variation introduced by SEM manufacturer AMR which was later known as AMRay. Shortly after KLA-Tencor purchased AMRay, production of the AMRay SEMs ceased. The AMRay pin stubs are only used by the installed base, which is getting smaller.

#### 3. Shorter pin of 6mm (0.23") for Zeiss / LEO

The pin stubs with the shorter 6mm pin are a variation introduced by Zeiss. Due to the construction of the sample stage in the SEM, only the short pin stubs should be used on SEMs made by Zeiss and LEO.

Note: Most types of pin stubs are available with the shorter pin. However, the choice the standards pin stubs is more extensive. To make a specific SEM sample pin stub compatible with the Zeiss/LEO SEMS the standard pin can easily be shortened to 6mm.

## Cylinder Mounts for JEOL

Plain cylinder mounts are used on SEMs manufactured by JEOL. The holders on the SEM sample stage are designed to hold cylinder stubs with either 9.5mm, 12.2mm, 25, 32 and 50mm diameter stubs. Most common heights are 5 or 10mm. For thin samples there are higher cylinder stubs available as well. The JEOL cylinder stubs are placed in stub holders which often have a way of adjusting the height and secured the stubs with a screw on the side. The stub holders are then placed on the SEM stage.

There are also JEOL cylinder stubs with pre-tilt angles available. Preparation on the stubs is easy since the stubs are stable when placed on a flat surface. Based on the stubs and compatible with the stub holders, there are also simple sample holders and sample stubs with pre-tilt, clips or vices available. Preparation stands are advised when preparing multiple stubs.

## Cylinder Mounts with M4 threaded hole for Hitachi

The cylinder mounts with a threaded hole in the base are a variation on the cylinder stub design and is used on the Hitachi SEMs. They are available from 15 to 100mm diameter with standard heights of 6 and 10mm. To use the Hitachi stubs in the SEM they are screwed onto an M4 thread until they lock. The M4 screw is often positioned on the end of a stub extender with an M6 thread which can be used to adjust the height on the SEM stage.

There are also Hitachi SEM stubs with pre-tilt angles available; these are convenient for imaging samples at a 45 or 90 degree angle without tilting the stage. Preparation on the stubs is easy; they sit stable on a flat surface. Based on the Hitachi stub design there are also small sample holders with clips, clamps or vices to hold small samples. The use of preparation stands is advised when preparing multiple stubs.

## SEM Sample stub Adapters

SEM sample stub adapters are an efficient and cost-effective way to use one type of SEM sample stub across different SEM platforms. No need to remount a sample which can be associated with all sorts of problems. They also allow to use calibration standards, mounted on a different stub, in the SEM at hand.

The SEM sample stub adapters available are:

- Cylinder adapters for pin stubs on JEOL SEMs
- Cylinder adapters for pin stubs on Hitachi SEMs
- Pin stub adapters for JEOL stubs on SEMs designed for pin stubs
- Pin stub adapters with M4 for Hitachi stubs on SEMs designed for pin stubs
- Cylinder adapters with M4 to use Hitachi stubs on JEOL SEMs
- Cylinder adapters to use JEOL stubs on a Hitachi SEM

Note: Some of the 25 and 32mm Hitachi stubs can be used on JEOL SEMs w/o the need for adapters.

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