to a measurement temperature is generally applicable to other semiconductor wafer processing apparatus and methods in which the temperature of a semiconductor wafer needs to be substantially equalised to a predetermined processing temperature.

Furthermore, the present inventors have realised that the same principles apply when it is desired to heat a semiconductor wafer to a desired processing temperature. In other words, the temperature matching to the desired (higher) processing temperature can be performed more accurately by separating the step of transferring the bulk of the heat load to the semiconductor wafer from the step of equalising the temperature of the semiconductor wafer to the desired processing temperature.

Therefore, at its most general the present invention relates to a semiconductor wafer processing method in which the bulk of a heat load of a semiconductor wafer is removed from, or transferred to, the semiconductor wafer before the temperature of the semiconductor wafer is substantially equalised to a predetermined processing temperature.

According to a first aspect of the present invention there is provided a semiconductor wafer processing method comprising:

controlling the temperature of a semiconductor wafer to be within a predetermined processing temperature range by:

causing a first change in the temperature of the semiconductor wafer using a first temperature changing unit; and

subsequently causing a second change in the temperature of the semiconductor wafer using a second temperature changing unit, wherein the second temperature changing unit comprises a thermal transfer plate that is thermally coupled to, or integral to, the processing area of the semiconductor wafer processing apparatus, so that the thermal transfer plate has substantially the same temperature

as the processing area of the semiconductor wafer processing apparatus;

wherein the magnitude of the first change is greater than the magnitude of the second change; and

subsequently loading the semiconductor wafer on to a processing area of a semiconductor wafer processing apparatus.

from the temperature changing unit and being placed on the processing area.

The method may comprise minimising a contact area between an end effector used to transport the semiconductor wafer and the semiconductor wafer, in order to limit thermal conduction between the end effector and the semiconductor wafer. For example, the end effector may only contact the semiconductor wafer at an edge of the semiconductor wafer. Furthermore, the method may comprise using poor (or low) conductivity materials in the end effector, so that there is poor thermal conductivity between the end effector and the semiconductor wafer.

The method may comprise heating the processing area of the processing apparatus to a temperature above ambient temperature, e.g. using one or more heaters attached to the processing area (e.g. attached to a processing enclosure, such as a measurement enclosure). Heating the processing area means that the temperature during transportation can be controlled with one or more heaters to be the same as the temperature of the processing area. For example, the processing temperature may be heated by a few °C (for example less than 4°C) above ambient temperature.

Alternatively, the method may comprise cooling the processing area of the processing apparatus to a temperature below ambient temperature, e.g. using one or more coolers. Cooling the processing area means that the temperature during transportation can be controlled with one or more coolers to be the same as the temperature of the processing area. For example, the processing area may be cooled by a few °C below ambient temperature.

According to a third aspect of the present invention there is provided a semiconductor wafer processing apparatus comprising:

a processing area;

a first temperature changing unit for causing a first change in the temperature of a semiconductor wafer; and

a second temperature changing unit for subsequently causing a second change in the temperature of the semiconductor wafer, wherein the second temperature changing unit comprises a thermal transfer plate that is thermally coupled to, or integral to, the processing area, so that the thermal transfer plate has substantially the same temperature as the processing area.~~, and~~

~~a processing area.~~

With the apparatus according to the third aspect of the present invention the first temperature changing unit can be used to remove the bulk of a heat load from the semiconductor wafer before the temperature of the semiconductor wafer is controlled to be within a predetermined processing temperature range using the second temperature changing unit. As such, the heat load on the second temperature changing unit when it is used to control the temperature of the semiconductor wafer to be within the predetermined processing temperature range may be significantly reduced relative to the conventional apparatus, and significant temperature change of the second temperature changing unit may be avoided. Therefore, the apparatus according to the third aspect of the present invention may be able to perform the semiconductor wafer processing more accurately than the conventional apparatus.

The apparatus may comprise a semiconductor wafer metrology apparatus, and the processing area may comprise a measurement area. Therefore, the apparatus according to the third aspect of the present invention may be able to perform semiconductor wafer metrology more accurately than conventional apparatus.

The first temperature changing unit may comprise a first cooling unit for cooling the semiconductor wafer.

The first cooling unit may be arranged to remove heat from the semiconductor wafer and dissipate (or transport) that heat away from the processing area of the semiconductor wafer processing apparatus. Therefore, the heat removed from the

semiconductor wafer when the semiconductor wafer is cooled using the first cooling unit may not be transported into the processing area. As such, this heat may have no effect on the