CLAIMS

WHAT IS CLAIMED IS:

1. A polishing apparatus which polishes a substrate, comprising:

a rotatable polishing table which supports a polishing pad;

a polishing head which presses the substrate against the polishing pad;

a rotating shaft connected to the polishing head;

a support structure which rotatably supports the rotating shaft;

a strain measuring instrument which measures a strain of the support structure; and

an end point detector which determines a polishing end point of the substrate on the basis of a change in the strain,

wherein the strain measuring instrument comprises at least one strain sensor fixed to the support structure, and

the strain measuring instrument has two measurement modes comprising a low resolution measurement mode which measures the strain at a first resolution, and a high resolution measurement mode which measures the strain at a second resolution higher than the first resolution.

~~2. The polishing apparatus according to claim 1, wherein the strain measuring instrument has two measurement modes comprising a low resolution measurement mode which measures the strain at a first resolution, and a high resolution measurement mode which measures the strain at a second resolution higher than the first resolution.~~

~~3~~2. The polishing apparatus according to claim ~~2~~1, wherein:

the low resolution measurement mode is a low gain mode which converts a first range of the strain into a predetermined measurement output range, and

the high resolution measurement mode is a high gain mode which converts a second range of the strain narrower than the first range into the measurement output range.

~~4~~3. The polishing apparatus according to claim ~~3~~2, wherein the strain measuring instrument comprises a signal converter which converts the first range into the measurement output range and converts the second range into the measurement output range, and the strain sensor is connected to the signal converter.

~~5~~4. The polishing apparatus according to ~~any one of~~ claim~~s~~ 2 ~~to 4~~or 3, wherein:

the strain measuring instrument comprises a first strain measuring instrument which is operated in the low resolution measurement mode, and a second strain measuring instrument which is operated in the high resolution measurement mode,

the first strain measuring instrument comprises a first strain sensor fixed to the support structure, and

the second strain measuring instrument comprises a second strain sensor fixed to the support structure.

~~6~~5. The polishing apparatus according to any one of claims 2 to ~~5~~4, wherein the end point detector is constituted to issue a command to the strain measuring instrument during the polishing of the substrate and to switch the measurement mode of the strain measuring instrument from the low resolution measurement mode to the high resolution measurement mode.

~~7~~6. A polishing method which polishes a substrate, comprising:

rotating a polishing table which supports a polishing pad;

polishing the substrate by pressing the substrate against the polishing pad with a polishing head connected to a rotating shaft;

measuring a strain of a support structure which rotatably supports the rotating shaft with a strain measuring instrument during polishing of the substrate; and

determining a polishing end point of the substrate on the basis of a change in the strain,

wherein the strain measuring instrument comprises at least one strain sensor fixed to the support structure,

wherein the polishing method further comprises switching a measurement mode of the strain measuring instrument from a low resolution measurement mode to a high resolution measurement mode during the polishing of the substrate,

wherein the low resolution measurement mode is a measurement mode which measures the strain at a first resolution,

the high resolution measurement mode is a measurement mode which measures the strain at a second resolution higher than the first resolution, and

the determining of the polishing end point of the substrate on the basis of the change in the strain is determining of the polishing end point of the substrate on the basis of the change in the strain measured in the high resolution measurement mode.

~~8. The polishing method according to claim 7, further comprising switching a measurement mode of the strain measuring instrument from a low resolution measurement mode to a high resolution measurement mode during the polishing of the substrate,~~

~~wherein the low resolution measurement mode is a measurement mode which measures the strain at a first resolution,~~

~~the high resolution measurement mode is a measurement mode which measures the strain at a second resolution higher than the first resolution, and~~

~~the determining of the polishing end point of the substrate on the basis of the change in the strain is determining of the polishing end point of the substrate on the basis of the change in the strain measured in the high resolution measurement mode.~~

~~9~~7. The polishing method according to claim ~~8~~6, wherein after the strain reaches a peak value during the polishing of the substrate, the measurement mode of the strain measuring instrument is switched from the low resolution measurement mode to the high resolution measurement mode.

~~10~~8. The polishing method according to claim ~~8 6~~ or ~~9~~7, further comprising adjusting an output value of the strain measuring instrument to a preset value after switching the measurement mode of the strain measuring instrument from the low resolution measurement mode to the high resolution measurement mode.

~~11~~9. The polishing method according to any one of claims ~~8 6~~ to ~~10~~8, wherein:

the low resolution measurement mode is a low gain mode which converts a first range of the strain into a predetermined measurement output range, and

the high resolution measurement mode is a high gain mode which converts a second range of the strain narrower than the first range into the measurement output range.

~~12~~10. The polishing method according to any one of claims ~~7 6~~ to ~~11~~9, further comprising calibrating the strain measuring instrument before polishing the substrate.

~~13~~11. The polishing method according to claim ~~12~~10, wherein the calibrating of the strain measuring instrument comprises:

determining a first output value of the strain measuring instrument when a first force is applied to the support structure;

determining a second output value of the strain measuring instrument when a second force different from the first force is applied to the support structure; and

adjusting the first output value and the second output value to a first reference value and a second reference value, respectively.