

SUBSTRATE PROCESSING APPARATUS, SUBSTRATE PROCESSING METHOD, METHOD OF MANUFACTURING SEMICONDUCTOR DEVICE, AND PROGRAM

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2020-162999, filed on September 29, 2020, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to a technique of stopping a substrate processing apparatus when an earthquake occurs.

BACKGROUND

[0003] In the related art, as an earthquake countermeasure in a substrate processing apparatus, a configuration is disclosed in which a boat fall prevention pin and a boat fall prevention wall are arranged to prevent a boat from falling in the event of an earthquake.

[0004] However, in the substrate processing apparatus in the related art, since a person may determine whether to perform a transfer stop process and press a transfer stop button, a transfer mechanism may not be stopped in a case where there is no person near the apparatus when an earthquake occurs.

SUMMARY

[0005] Some embodiments of the present disclosure provide a technique capable of detecting vibrations of an initial tremor (P) wave and a principal fluctuation (S) wave in the event of an earthquake, to perform an appropriate transfer stopping operation.

[0006] According to embodiments of the present disclosure, there is provided a configuration that includes: at least one transfer mechanism configured to transfer a substrate and at least one

WHAT IS CLAIMED IS:

1. A substrate processing apparatus comprising:
 - at least one transfer mechanism configured to transfer a substrate and at least one processing mechanism configured to process the substrate;
 - an earthquake detector configured to detect an earthquake; and
 - a controller configured to control the at least one transfer mechanism and the at least one processing mechanism according to a detection result of the earthquake detector,wherein the controller is configured to be capable of:
 - performing an operation of the at least one transfer mechanism according to a stopping method that has been individually pre-selected for a detection signal of each of a P wave (initial tremor wave) and an S wave (principal fluctuation wave), in response to receiving the detection signal of each of the P wave and the S wave from the earthquake detector; and
 - controlling the stopping method for the detection signal of the S wave to be different from the stopping method for the detection signal of the P wave,wherein the stopping method for the detection signal of each of the P wave and the S wave is pre-selected from a group of a plurality of stopping operations and a no-stopping operation, and
 - wherein, if the no-stopping operation has been pre-selected as the stopping method, the controller is capable of controlling a substrate process to continue.
2. The substrate processing apparatus of Claim 1, wherein the stopping method is one of a deceleration stop operation, an immediate stop operation, a step stop operation, a cycle stop operation, and the no-stopping operation.
 3. The substrate processing apparatus of Claim 1, wherein the at least one transfer mechanism includes a plurality of transfer mechanisms, and

wherein the stopping method is configured to be capable of being selected with respect to each of the transfer mechanisms according to the detection result from the earthquake detector.

4. The substrate processing apparatus of Claim 1, wherein the at least one transfer mechanism is at least one selected from the group of a pod conveyor, a substrate conveyor, a boat elevator, and a rotator.

5. The substrate processing apparatus of Claim 4, wherein when a stopping operation of the boat elevator of the at least one transfer mechanism is set to the cycle stop operation, the boat elevator is configured to be capable of returning a boat to an initial position regardless of whether the boat is being raised or being lowered.

6. The substrate processing apparatus of Claim 4, wherein when a stopping operation of the boat elevator of the at least one transfer mechanism is not set, the controller is configured to be capable of performing a substrate processing process including a loading step, a processing step, and an unloading step even when the earthquake is detected while a boat is being raised.

7. The substrate processing apparatus of Claim 1, wherein the at least one transfer mechanism is configured to be capable of setting presence or absence of the stopping operation.

8. The substrate processing apparatus of Claim 1, wherein when the P wave is detected, the controller is configured to be capable of maintaining an earthquake detection alarm even when the S wave is not detected.

9. The substrate processing apparatus of Claim 1, wherein the controller is configured to be capable of selecting the stopping operation of the at least one transfer mechanism according to an earthquake intensity.

10. The substrate processing apparatus of Claim 1, wherein the at least one processing mechanism includes a plurality of processing mechanisms, and
wherein a stopping operation is configured to be capable of being set with respect to each of the processing mechanisms.
11. The substrate processing apparatus of Claim 1, wherein the controller is configured to be capable of selecting an operation of the at least one processing mechanism according to the P wave and the S wave.
12. The substrate processing apparatus of Claim 1, wherein the at least one processing mechanism includes a plurality of processing mechanisms, and
wherein a stopping operation is configured to be capable of being selected with respect to each of the processing mechanisms according to the detection result from the earthquake detector.
13. The substrate processing apparatus of Claim 1, wherein the controller is configured to be capable of selecting a stopping operation of the at least one processing mechanism according to an earthquake intensity.
14. A method of manufacturing a semiconductor device, comprising:
individually pre-selecting a stopping method for a detection signal of each of a P wave (initial tremor wave) and an S wave (principal fluctuation wave);
a substrate transferring process of operating at least one transfer mechanism configured to transfer a substrate;
a substrate processing process of operating at least one processing mechanism configured to process the substrate;
receiving, from an earthquake detector, a detection signal of each of the P wave and the

S wave of an earthquake detected during execution of the substrate transferring process or the substrate processing process; and

performing an operation of the at least one transfer mechanism according to the pre-selected stopping method in response to receiving the detection signal of each of the P wave and the S wave; and

controlling the stopping method for the detection signal of the S wave to be different from the stopping method for the detection signal of the P wave,

wherein the stopping method for the detection signal of each of the P wave and the S wave is pre-selected from a group of a plurality of stopping operations and a no-stopping operation, and

wherein, in the act of performing the stopping operation, if the no-stopping operation has been pre-selected as the stopping method, the substrate continues to be processed.

15. A program that causes a controller to perform a process, wherein the program is executed in a substrate processing apparatus including at least one transfer mechanism configured to transfer a substrate, at least one processing mechanism configured to process the substrate, an earthquake detector configured to detect an earthquake, and the controller configured to control the at least one transfer mechanism and the at least one processing mechanism according to a detection result of the earthquake detector, the controller being configured to be capable of performing a stopping operation of the at least one transfer mechanism according to a P wave (initial tremor wave) and an S wave (principal fluctuation wave), the process comprising:

individually pre-selecting a stopping method for a detection signal of each of the P wave and the S wave;

receiving, from the earthquake detector, the detection signal of each of the P wave and the S wave of the earthquake; and

performing the operation of the at least one transfer mechanism according to the pre-selected stopping method in response to receiving the detection signal of each of the P wave and

the S wave; and

controlling the stopping method for the detection signal of the S wave to be different from the stopping method for the detection signal of the P wave,

wherein the stopping method for the detection signal of each of the P wave and the S wave is pre-selected from a group of a plurality of stopping operations and a no-stopping operation, and

wherein, in the act of performing the stopping operation, if the no-stopping operation has been pre-selected as the stopping method, the controller is capable of controlling a substrate process to continue.

16. A substrate processing method, comprising:

individually pre-selecting a stopping method for a detection signal of each of a P wave (initial tremor wave) and an S wave (principal fluctuation wave);

a substrate transferring process of operating at least one transfer mechanism configured to transfer a substrate;

a substrate processing process of operating at least one processing mechanism configured to process the substrate;

receiving, from an earthquake detector, a detection signal of each of the P wave and the S wave of an earthquake detected during execution of the substrate transferring process or the substrate processing process;

performing an operation of the at least one transfer mechanism according to the pre-selected stopping method in response to receiving the detection signal of each of the P wave and the S wave; and

controlling the stopping method for the detection signal of the S wave to be different from the stopping method for the detection signal of the P wave,

wherein the stopping method for the detection signal of each of the P wave and the S wave is pre-selected from a group of a plurality of stopping operations and no-stopping operation, and

wherein, if the no-stopping operation has been pre-selected as the stopping method, the substrate continues to be processed.