CLAIMS

[Claim 1]

An information processing device comprising:

an information acquisition unit that acquires reliability degradation factor state information in a chemical mechanical polishing process of a substrate performed by a substrate processing device, the reliability degradation factor state information including at least one of wear state information indicating a wear state of components of the substrate processing device and processing state information indicating a processing state during polishing; and

a state prediction unit that predicts reliability information of a polishing endpoint detection function for the reliability degradation factor state information by inputting the reliability degradation factor state information acquired by the information acquisition unit into a learning model that has been trained through machine learning to learn a correlation between the reliability degradation factor state information and reliability information of the polishing endpoint detection function that indicates reliability of an endpoint detection function that detects that the chemical mechanical polishing process has reached an endpoint.

[Claim 2]

The information processing device according to claim 1, wherein

the substrate processing device further includes:

a polishing table that rotatably supports a polishing pad;

a top ring that presses a substrate against the polishing pad;

a dresser that rotatably supports a dresser disk and brings the dresser disk into contact with the polishing pad to dress the polishing pad; and

a substrate processing control unit that controls the entire substrate processing device, and

the wear state information includes at least one of:

a condition of the polishing pad;

a condition of a rotary connector that rotatably installs the top ring and the polishing table;

a condition of the dresser; and

a condition of the substrate processing control unit.

[Claim 3]

The information processing device according to claim 2, wherein

the substrate processing device further includes:

a transparent liquid supply unit that supplies a transparent liquid to the polishing pad; and

an optical sensor that measures a reflection intensity of light from a lamp that emits light to detect that the chemical mechanical polishing process has reached an endpoint, and

the wear state information includes at least one of:

a condition of the optical sensor; and

a condition of the transparent liquid supply unit.

[Claim 4]

The information processing device according to claim 2 or 3, wherein

the substrate processing device includes:

a polishing table that rotatably supports a polishing pad;

a top ring that presses a substrate against the polishing pad; and

a polishing fluid supply unit that supplies a polishing fluid to the polishing pad,

the top ring includes:

a top ring body that is moved by a rotational movement mechanism, a vertical movement mechanism, and a swing movement mechanism;

an elastic membrane that is housed in the top ring body and presses the substrate against the polishing pad in response to pressurizing fluid supplied to an elastic membrane pressure chamber;

a retainer ring that is disposed on an outer periphery of the elastic membrane and presses the polishing pad; and

a retainer ring pressing mechanism that adjusts a pressing force of the retainer ring, and

wherein the processing state information includes at least one of:

a flow rate of the polishing fluid;

a pressing force of the retainer ring pressing mechanism;

a rotational torque of the top ring and the polishing table;

a swing torque of the top ring;

a vibration of the top ring;

a swing torque of the dresser;

noise of the top ring during polishing;

a temperature of the polishing surface of the top ring during polishing;

a temperature of a temperature-controlled water of the polishing table;

a statistical value of the time until the endpoint is detected for each substrate; and

a statistical value of time-series data of each sensor for each substrate.

[Claim 5]

The information processing device according to claim 4, wherein

the substrate processing device further includes:

a transparent liquid supply unit that supplies a transparent liquid to the polishing pad; and

an optical sensor that detects that the chemical mechanical polishing process has reached an endpoint, and

the processing state information includes at least one of:

a light reflection intensity of the optical sensor; and

a flow rate of the transparent liquid.

[Claim 6]

The information processing device according to claim 1, wherein

the reliability information of the polishing endpoint detection function includes at least one of:

current endpoint detection reliability information;

sign information of reliability degradation;

type information of the components of the substrate processing device that cause reliability degradation; and

type information of a substrate processing process that causes reliability degradation.

[Claim 7]

A machine learning device comprising:

a learning data storage unit that stores a plurality of sets of learning data consisting of reliability degradation factor state information in a chemical mechanical

polishing process of a substrate performed by a substrate processing device, the reliability degradation factor state information including at least one of wear state information indicating a wear state of components of the substrate processing device and processing state information indicating a processing state during polishing, and reliability information of a polishing endpoint detection function that indicates reliability of an endpoint detection function that detects that the chemical mechanical polishing process has reached an endpoint;

a machine learning unit that causes a learning model to learn a correlation between the reliability degradation factor state information and the reliability information of the polishing endpoint detection function by inputting the plurality of sets of learning data to the learning model; and

a trained model storage unit that stores the learning model trained with the correlation by the machine learning unit.

[Claim 8]

An information processing method comprising:

an information acquisition step of acquiring reliability degradation factor state information in a chemical mechanical polishing process of a substrate performed by a substrate processing device, the reliability degradation factor state information including at least one of wear state information indicating a wear state of components of the substrate processing device and processing state information indicating a processing state during polishing; and

a state prediction step of predicting reliability information of a polishing endpoint detection function for the reliability degradation factor state information by inputting the reliability degradation factor state information acquired by the information acquisition step into a learning model that has been trained through machine learning to learn a correlation between the reliability degradation factor state information and reliability information of the polishing endpoint detection function that indicates reliability of an endpoint detection function that detects that the chemical mechanical polishing process has reached an endpoint.

[Claim 9]

A machine learning method comprising:

a learning data storage step of storing a plurality of sets of learning data

consisting of reliability degradation factor state information in a chemical mechanical polishing process of a substrate performed by a substrate processing device, the reliability degradation factor state information including at least one of wear state information indicating a wear state of components of the substrate processing device and processing state information indicating a processing state during polishing, and reliability information of a polishing endpoint detection function that indicates reliability of an endpoint detection function that detects that the chemical mechanical polishing process has reached an endpoint;

a machine learning step of causing a learning model to learn a correlation between the reliability degradation factor state information and the reliability information of the polishing endpoint detection function by inputting the plurality of sets of learning data to the learning model; and

a learning data storage step of storing a plurality of sets of the learning models trained to learn the correlation in the machine learning step in a learning data storage unit.