

Description

The present invention relates to sputter coating and more particularly to the management and use of information, in a sputter coating system, relating to the identity, characteristics and history of a sputtering target.

Background of the Invention

Sputter coating is a process carried out in a vacuum chamber which is filled with a generally chemically inert gas in which a substrate is coated with a material from a target of sputtering material subjected to a negative electrical potential with respect to the chamber wall or other anode. The potential gradient adjacent the target surface causes electrons to be emitted from the target which, on their way to the chamber anode which is usually formed in part by the grounded chamber wall, strike and ionize some of the inert gas. The positive ions formed are then attracted to the negative target which they strike, transferring momentum to the target material, and ejecting particles of the material from the target surface. The substrate to be coated, which is positioned in the chamber usually with its surface facing the target, receives some of the ejected particles which adhere to and coat the substrate surface.

Magnetron sputtering is a sputter coating process in which a magnetic field is formed over the target surface, usually including magnetic field lines parallel to the target surface, and, in many applications, in the form of a closed magnetic tunnel. The magnetic field causes the electrons emitted to move in curved spiral paths which trap them in regions proximate the target surface enclosed by the field, thereby increasing the rate of electron collisions with gas atoms, which in turn increase the ionization of the gas and the efficiency of the sputtering process.

In magnetron sputter coating processes, the sputtering of materials from the sputtering target occurs most rapidly into regions of the target where the plasma trapped by the magnetic field is the most dense. This causes the proportionate consumption or erosion of the sputtering material from the target surface. The erosion of sputtering material from other portions of the sputtering target surface generally occurs at a rate which varies in proportion to the strength and/or duration of the plasma over that portion of the target surface. Such erosion of the target at different rates across the target surface is sometimes desirable to achieve, for example, uniform coating of the substrate, as for example is described in the commonly assigned U.S. Patent No. 4,957,605, hereby expressly incorporated herein by reference.

The shape of a sputtering target as well as its composition determine the operating parameters of the sputtering machine, such as the sputtering power levels, the characteristics of the magnetic fields over the target, the gas composition and pressure within the sputtering chamber, the sputtering process time, and other factors, to which the machine must be set for operation. The shape of the sputtering target varies with the use of the target as the target erodes. The history of the use of the target and of the parameter settings over the course of the history of the target affect the characteristics of the target, including particularly its shape, at any point in the life of the target. Thus, parameter settings for optimal use of the target at any point in time will vary with the history of the use of the particular target. In addition, variations from target to target, such as variations in composition, texture or crystal structure, may require different adjustments in operating parameters of the machine for optimal performance of the sputter coating process. Such adjustments will be experienced as the target is used. Furthermore, the identity of the particular target and information regarding its composition and history of use will, in some cases, be important in evaluating the coated products produced with the sputtering target at any point in its life. This is particularly important when targets are replaced and when targets which have been previously used are installed in a sputtering machine. The use of information regarding the parameters associated with the sputtering process, are discussed in U.S. Patent No. 5 126 028, entitled "Sputter Coating Process Control Method and Apparatus", hereby expressly incorporated herein by reference.

The use of information regarding the identity, characteristics and history of the sputtering target, and the correlation of that information with the products produced by the target has generally been a manual process. Similarly, proper settings of the operating parameters of the machine have required manual decision making by the machine operator. As a result, there has been inadequate utilisation of information regarding the target, and consequent inefficiency and a risk of error.

Accordingly, there is a need to provide a method and apparatus for effectively maintaining and utilising information regarding the sputtering target in a sputter coating process.

U.S. Patent 4902398 describes a sputtering process, the steps of which are preprogrammed and computer controlled. The parameter necessary to control a run includes the chamber pressure, the power levels, the speed of passage of the material to be coated and the plasma-forming gas composition. The source target type and its "life" are employed in determining the power level. The

sputtering time of a target in use is monitored and its "life" value is appropriately decremented. No details as to the source of the initial "life" information are given.

U.S. Patent 4166783 describes a sputtering system with a computer for monitoring power dissipation in the sputtering source and accumulating the history of usage of the particular sputtering target which is in use. Desired deposition rate information is input to the computer as is criteria to allow determination of the end of useful target life. The computer monitors the cumulative history of each in-use cathode to allow updating and modification of the input information. Information specific to a particular target is not, at least initially, available for use in controlling the sputtering process.

An expandable target of sputter coating material, in accordance with the invention, has secured thereto a storage medium having recorded thereon, in machine readable indicia, information relating to the target.

A method of manufacturing a sputter coated article, in accordance with the invention, comprises the steps of installing in a sputter coating chamber of a sputter coating apparatus a target of sputter coating material and performing a sputter coating process through the use of the target to deposit a coating of the sputter coating material on an article, characterised in that the target has a medium carrying machine readable information carried thereby and in that the method includes reading with a reader carried by the apparatus information from the medium and storing in a memory, information regarding the use of the target, the information including information read from the medium.

The present invention provides a sputtering coating method and apparatus in which information relating to the specific target present at any point in time in a processing chamber of a sputter coating machine is immediately and reliably available. In a particularly preferred embodiment, information relating to the identity, characteristics or history of a sputtering target which is installed in the processing chamber of a sputter coating machine is made available.

A preferred sputtering target assembly has machine readable indicia recorded on a medium carried by an expendable target or portion of the target assembly which is removable with the target. A sputter coating apparatus has a sputtering chamber, in which the target is supported, having a sensor or reader for reading information from the medium.

In the preferred embodiment of the invention, the indicia is coded with unique target identifying information, such as a serial number, which identifies the target and may be correlated with information stored in a memory of the apparatus

relating to the characteristics of the target, its composition and/or its history of use. In the alternative, the information coded on the medium may include information of the composition or other characteristics of the target, and may also include the history of the use of the target.

In its alternative embodiments, the medium may be a read only memory which is suitable for recording the target identifying information or the unchanging characteristics of the target such as the target composition. The medium may also be a read/write memory which is suitable for recording information such as target history, which may be updated after each run by writing devices within the sputtering machine in which the target is being used, or may carry date, time, batch number or other such information. Alternatively, a storage medium may be written or coded in machine readable form at a location remote from the sputtering chamber and then affixed to the target, the target backing plate, or other structure to which the target is bonded or otherwise secured, when the target is removed from the apparatus.

Where the sputtering material of the target is alone removable for replacement, it is preferable that the medium be carried upon the sputtering material of the target so that it cannot be separable therefrom and is destroyed when the remaining material of the target is recycled at the end of the target life. On the other hand, where the target material is formed and bonded to a nest or backing plate which is removable with the target for replacement, the medium may be carried by the backing plate. In such a case, the medium should be such as to be destructible in the process by which the target material is removed from or bonded to the backing plate so that new information can be coded onto the assembly which corresponds to the new target material.

Further the sputtering process is preferable carried out by providing a target with coded indicia recorded thereon, in a read-only medium, which uniquely identifies the target and which, in addition, carries information of certain unchangeable data such as the composition of the target or the target design or type. A read head in the apparatus is fixed in the sputtering chamber to read the information from the indicia. The head is connected to circuitry for storing the information in a memory in the machine. A read/write medium on the target contains further information regarding the history of the use of the target, and initially is set to indicate that the target is new. A read/write head in the apparatus is positioned to read information from the read/write medium and to rewrite the information in updated form to indicate the usage put on the target while in the apparatus. Thus, if the target is removed and later reinstalled in the same or

another apparatus equipped with features for reading the recorded information, an accurate up-to-date record of the history of the use of the target, and thus information to determine the condition of the target, is available to the sputtering machine. The apparatus preferably includes a microprocessor capable of using the information for analysis of the process or control of the apparatus.

According to the preferred embodiment of the invention, the indicia carrying medium is situated on the back of the target or backing plate to which the target is bonded to be read from or written to from behind the target holder outside of the environment of the sputtering chamber.

These and other objectives and advantages of the present invention will be more readily apparent from the following detailed description of the drawings in which:

Brief Description of the Drawings

Fig. 1 is a cross-sectional view through of one preferred embodiment of a sputter coating apparatus embodying principles of the present invention.

Fig. 2 is a cross-sectional view of the target assembly of the apparatus of Fig. 1.

Fig. 3 is an enlarged view of the area of the encircled portion 3 of Fig. 1.

Fig. 4 is a flow chart of one preferred embodiment of the operation of the apparatus of Fig. 1.

Detailed Description of Drawings

Sputtering machines of the type to which the present invention relates are described in the following commonly assigned U.S. patents which are hereby expressly incorporated in their entirety into this application by reference:

U.S. Patent Nos. 4,909,695 and 4,915,564 entitled "Method and Apparatus for Handling and Processing Wafer-Like Materials"; U.S. Patent No. 4,957,605, entitled "Method and Apparatus for Sputter Coating Stepped Wafers"; and U.S. Patent No. 5 130 005.

The preferred embodiment of the present invention is set forth herein as the sputtering target and cathode assembly of U.S. Patent 5 130 005 incorporated by reference above, as illustrated in most pertinent part in Figs. 1 and 2.

Referring to Fig. 1, shown in cross-section is a sputter coating processing chamber 10 of a sputter coating apparatus. The chamber 10 is a portion of the sputter processing apparatus disclosed in U.S. Patent 4,909,695.

A backplane space 19 is enclosed within the processing chamber 10. Within the processing chamber 10 between the backplane space 19 and the cathode assembly module 20 is a substrate or

workpiece 21 in the form of a flat silicon wafer or disk which has the surface 22 upon which a coating is to be deposited in a sputter coating process to be performed within the processing chamber 10. The wafer 21 is supported in a wafer holder 25. Preferably, the wafer 21 is supported in a plane perpendicular to, and concentric with, a central axis 27 of the processing chamber 10.

The cathode assembly module 20 carries the sputtering target 40, which may be, for example, a circular target having a continuous smooth concave sputtering surface 41 and a back surface 39. The cathode assembly module 20 supports the target 40 with its axis in alignment with the axis 27 of the chamber 10 and with its sputtering surface 41 facing the surface 22 of the wafer 21 to be coated.

The target 40 is supported in a target nest, holder or backing plate 42 having a front surface 43 conforming to surface 39 and concentric with axis 27. The back surface 39 of the target 40 is preferably soldered or otherwise bonded to the front surface 43 of the backing plate 42, in intimate thermal contact therewith. The target back surface 39 is a cooling surface which, when the target 40 is mounted in holder 42, conforms to and lies in close cooling contact with the surface 43 of the holder 42. Behind the backing plate 42, opposite the cooling surface 43 thereof, is a space 44 for the circulation of cooling liquid, which is generally water, to remove heat generated in the target 40 during sputtering by cooling the heat conductive target holder 42. The cooling fluid is circulated into and out of the space 44 from an inlet port 45 to an outlet port 46 in a magnet assembly 50, as described below. The space 44 is enclosed behind the backing plate 42 by a housing structure 48 onto which the backing plate 42 is rigidly supported, and to which it is secured by bolts 49.

Preferred shapes of the surfaces of the target 40 are those capable of being formed by turning a block of sputtering material on a lathe. The target holder 42 is made of a heat conductive and electrically conductive material, preferably hard tempered OFHC copper or Alloy 110.

In the illustrated embodiment the magnet assembly 50 includes a shaft 51 having a threaded end 52 by which the shaft 51 is rigidly mounted in a threaded bore 53 at the center of the back surface of the backing plate 42. The assembly 50 also includes a rotatable magnet carrier assembly 55 which includes a circular disk 56 of non-magnetic stainless steel or other such material having a central hole 57 therein at which the disk 56 is rigidly mounted to a sleeve assembly 58 rotatably mounted through a bearing assembly 59 through the housing 48 and to the backing plate 42 to rotate about the shaft 51 on the axis 27. The rotatable magnet assembly further includes a mag-

net structure 60 rigidly mounted on the disk 56 to rotate therewith. The magnet 60 surrounds the axis 27 and lies beneath or behind the backing plate 42, opposite the front surface 43 thereof, and close enough thereto to generate a closed magnetic field above the sputtering surface 41 of the target 40 mounted on the surface 43 of the backing plate 42.

The shaft 51 has a cooling fluid inlet duct 62 extending therethrough which communicates with the inlet port 45 to the interior cooling chamber 44 between the backing plate 42 and the housing 48. The housing 48 has mounted near the edge thereof a cooling fluid outlet duct 63 which communicates with the fluid outlet port 46 in the cooling space 44.

Mounted to the back of the housing 48 is a bracket 64 to which is mounted a magnet rotary drive motor 65. The motor 65 has an output shaft 66 with a cogged drive wheel 67 mounted at the end thereof for driving a cogged drive belt 68. The belt 68 extends around a cogged drive wheel 69 attached to a drive shaft 70 which is rotatably mounted on the housing 48 extending therethrough and having a free end 71 to which is mounted a drive gear 72. The drive gear 72 is positioned within the space 44 where it engages a mating gear 74 attached to the disk 56 of the rotatable magnet assembly 50. Accordingly, the motor 65, when energized, rotates the magnet assembly 50 to rotate the magnet 60 behind the target backing plate 42 to rotate the magnetic field over the sputtering surface 41 of the target 40.

The details of the construction of the magnet structure 60 and its arrangement on the magnet assembly 50 can be better understood by reference to Fig. 2. The magnet structure 60 is a non-concentric loop magnet 80, which is held in place in a particular predetermined shape surrounding axis 27 by clamping blocks 81-83.

Referring to Figs. 1 and 2, the magnet carrier assembly 55 has extending therethrough a hole 100, which may be an filled with an optically transparent lens 101, in the clamping block 83 and the plate 56. Secured to, and embedded so as to be flush with, the back of the target backing plate 42 so as to align with the hole 100, when in one angular position, is a read-only medium carrying indicia, such as an optically readable bar-code 103. Adjacent the housing 48, opposite the bar-code 103, is a conventional bar-code reading head 104, which may include a laser light source and receiver. The lens 101 may be such as to scan the bar code to transmit the laser light to and from the bar-code 103 so as to be read by the sensor of the reader 104 outside of a window 107 in the housing 48.

In the alternative embodiment of Fig. 3, the medium carrying the bar-code 103a is carried directly by the target 40 on the back surface 39

thereof. In this embodiment, a hole 105 is provided in the backing plate 42 to expose the bar code 103a to be viewed from behind the backing plate 42.

In a further embodiment the bar code or other storage device 103b is mounted to an external flange 37 of the backing plate 42 to be read by the reader 104b mounted external of the housing 48.

The sensor of the reader 104 has signal lines 106 connected to terminals of a microprocessor 108 which is, in turn, provided with a bus connected to a memory 110. The information on the bar code is, in one embodiment, a serial number of the target 40. In the memory 110 is stored, in this embodiment, information regarding the composition of the target and data regarding the history of the target 40 and of other targets correlated with the respective targets by serial number. Controls 125 of the apparatus may be connected to an output of the microprocessor 108 which, through a control program, may respond to the composition and history data stored in the memory 110. In this way, the control 125 may, with outputs connected to a target power supply 127, for example, control parameters of the process such as the power applied to the target during the sputtering operation, all as more particularly described in the above incorporated Patent No. 5 126 028.

In other embodiments, the storage device 103, 103a or 103b may contain information such as the target composition or target power limits.

In further alternative embodiments, a non-volatile read/write medium is provided in, or in addition to, the storage device 103. In such embodiments, a read/write device is provided in, or in addition to, the reader 104 or 104b and connected to input/output ports of the microprocessor 108 through lines 106. With the read/write medium and read/write head, data such as the history of the usage of the target in the apparatus, as, for example, power applied to the target, total energy consumed by the target, processing time, the date and time of the processing operation, the batch numbers or other wafer identification information, may be stored by the head 114 on the medium 113.

The indicia recording media 103 affixed to the target backing plate target is in a form that will be destroyed by the bonding process by which a new target is attached to the backing plate 42. For example, a bar code may be written with ink that fades at a temperature required for bonding a target to the backing plate by soldering should that be the bonding method employed. Alternatively, the medium may be made of a material that will melt at the bonding temperature, or may be affixed to a structure that will be mechanically destroyed in bonding or debonding of a target.

The operation of the invention will be best understood by reference to Fig. 4, which is a flow chart of the operation of the microprocessor 108 and control 125 according to one embodiment of the invention. Upon or following the installation of a target, the indicia affixed to the target or backing plate is caused to be read. Then the information, if any, that is read is tested to determine whether there is in fact machine readable indicia carried by the target. If there is none, some unique identification is assigned to the target so that information regarding the target may be recorded. Thus, it will not be necessary that the target be provided with a machine readable code in order for the target to be used in the sputtering apparatus. Such a target will be used with the operating parameters of the machine set in any manner used prior to the provision of the present invention. Such parameters may be manually entered or set to default settings by the machine control.

If machine readable indicia recognized by the microprocessor program is read from the target, then the target identification code is interpreted by the program and any other information recorded on and read from the target is interpreted. Such other information may be that of the type of material of the target, of special parameter settings, or of the history of the past use of the target. Such past use may be that of the total sputtering energy consumed by the target over its life to date, which can be used as an indication of the state of erosion of the target and thus its surface contour.

The interpreted identity of the target is then compared with information stored in the memory 110 to determine whether the target has been previously used in the apparatus, or to determine whether information regarding the target being installed has been loaded into the memory. If the identity of the target in the memory is not found, an entry of the target identification is made in the memory and the other information, if any, read from the target is stored corresponding storage locations in the memory. In certain embodiments, it may be preferable to read only a target identification code, and perhaps also a target material type, from the target and resort to information pre-stored in the memory along with the target identity code.

Next, the information read from the target and retrieved from the memory relating to the target is checked to determine whether there is sufficient information by which the machine operating parameters can be set so that a sputter coating process can be performed with the newly installed target. If sufficient information is not present, then provision is made for the manual entry of additional information by an operator or for the assignment of program selected or default parameter settings.

If sufficient information is read from the target or retrieved from the memory relating to the target, then the information is interpreted and parameters are set for the operation of the apparatus to perform the sputter coating process. Information of the age of the target and of the target material may be used to set sputtering power levels, for example. The target type and target material may also be used to set maximum power limits.

Once the parameters are set, the process can be initiated. As the process is performed, a clock and calendar may cause the date and time to be recorded in memory, along with the parameter settings by which the process is being performed with the target. Also, information such as the wafer batch numbers and number of substrates being coated may be recorded in memory locations corresponding to the target. Preferably, the time in use and the power levels applied to the target, together with a log of the total energy being applied to the target, are recorded for the target. For each use of the target thereafter, this information is updated for the target in the memory.

Preferably, the stored information is written onto the target medium, or onto a medium which can be affixed to the target. The writing of the information may be done directly in the apparatus with the write head 114 writing onto the writable medium 113. However, in that the environment in the chamber is generally hostile to many desirable writing techniques, a medium may be written with the updating information at a location remote from the sputtering chamber, in machine readable form, such as by the printing of an optically readable barcode, and the medium affixed to the target upon removal from the chamber.

Claims

1. An expendable target of sputter coating material, characterised in that the target has secured thereto a storage medium having recorded thereon, in machine readable indicia, information relating to the target.
2. A target as claimed in Claim 1, wherein the information recorded on the medium includes information relating to the identity of the target.
3. A target as claimed in either Claim 1 or Claim 2, wherein the information recorded on the medium includes information relating to the composition of the target.
4. A target as claimed in any preceding Claim, wherein the information recorded on the medium includes information relating to the history of the target.



The operation of the invention will be best understood by reference to Fig. 4, which is a flow chart of the operation of the microprocessor 108 and control 125 according to one embodiment of the invention. Upon or following the installation of a target, the indicia affixed to the target or backing plate is caused to be read. Then the information, if any, that is read is tested to determine whether there is in fact machine readable indicia carried by the target. If there is none, some unique identification is assigned to the target so that information regarding the target may be recorded. Thus, it will not be necessary that the target be provided with a machine readable code in order for the target to be used in the sputtering apparatus. Such a target will be used with the operating parameters of the machine set in any manner used prior to the provision of the present invention. Such parameters may be manually entered or set to default settings by the machine control.

If machine readable indicia recognized by the microprocessor program is read from the target, then the target identification code is interpreted by the program and any other information recorded on and read from the target is interpreted. Such other information may be that of the type of material of the target, of special parameter settings, or of the history of the past use of the target. Such past use may be that of the total sputtering energy consumed by the target over its life to date, which can be used as an indication of the state of erosion of the target and thus its surface contour.

The interpreted identity of the target is then compared with information stored in the memory 110 to determine whether the target has been previously used in the apparatus, or to determine whether information regarding the target being installed has been loaded into the memory. If the identity of the target in the memory is not found, an entry of the target identification is made in the memory and the other information, if any, read from the target is stored corresponding storage locations in the memory. In certain embodiments, it may be preferable to read only a target identification code, and perhaps also a target material type, from the target and resort to information pre-stored in the memory along with the target identity code.

Next, the information read from the target and retrieved from the memory relating to the target is checked to determine whether there is sufficient information by which the machine operating parameters can be set so that a sputter coating process can be performed with the newly installed target. If sufficient information is not present, then provision is made for the manual entry of additional information by an operator or for the assignment of program selected or default parameter settings.

If sufficient information is read from the target or retrieved from the memory relating to the target, then the information is interpreted and parameters are set for the operation of the apparatus to perform the sputter coating process. Information of the age of the target and of the target material may be used to set sputtering power levels, for example. The target type and target material may also be used to set maximum power limits.

Once the parameters are set, the process can be initiated. As the process is performed, a clock and calendar may cause the date and time to be recorded in memory, along with the parameter settings by which the process is being performed with the target. Also, information such as the wafer batch numbers and number of substrates being coated may be recorded in memory locations corresponding to the target. Preferably, the time in use and the power levels applied to the target, together with a log of the total energy being applied to the target, are recorded for the target. For each use of the target thereafter, this information is updated for the target in the memory.

Preferably, the stored information is written onto the target medium, or onto a medium which can be affixed to the target. The writing of the information may be done directly in the apparatus with the write head 114 writing onto the writable medium 113. However, in that the environment in the chamber is generally hostile to many desirable writing techniques, a medium may be written with the updating information at a location remote from the sputtering chamber, in machine readable form, such as by the printing of an optically readable barcode, and the medium affixed to the target upon removal from the chamber.

Claims

1. An expendable target of sputter coating material, characterised in that the target has secured thereto a storage medium having recorded thereon, in machine readable indicia, information relating to the target.
2. A target as claimed in Claim 1, wherein the information recorded on the medium includes information relating to the identity of the target.
3. A target as claimed in either Claim 1 or Claim 2, wherein the information recorded on the medium includes information relating to the composition of the target.
4. A target as claimed in any preceding Claim, wherein the information recorded on the medium includes information relating to the history of the target.



5. A target as claimed in any preceding Claim, wherein the medium is a read-write medium.
6. A target as claimed in any one of Claims 1 to 4, wherein the medium is a read-only medium. 5
7. A target as claimed in any preceding Claim, wherein the medium is carried by the sputter coating material. 10
8. A target as claimed in any one of Claims 1 to 7, further comprising a target support having the sputter coating material secured thereto, the medium being carried by the support. 15
9. A target as claimed in Claim 8, wherein the medium is disposed on the target support such that information recorded thereon is destroyed by a process of either removing the target from or securing the target to the target support. 20
10. A target as claimed in either Claim 8 or Claim 9, wherein the target support is secured to the target such that the target must be heated to a threshold temperature to remove the target from the target support and the medium is thermally erasable, and erases information stored therein at or below said threshold temperature. 25 30
11. A target as claimed in any one of Claims 8 to 10, wherein the medium is disposed on the back of the target support and the reading means is positioned behind the target support. 35
12. A sputter coating apparatus comprising structure defining a sputter processing chamber, a target as claimed in any one of Claims 1 to 11 supported in the chamber, and means carried by the structure and positioned for reading the information from the storage medium. 40
13. Apparatus as claimed in Claim 12, wherein the information recorded on the medium is information relating to the identity of the target and the apparatus further comprises means coupled to the reading means for storing information relating to the identity of the target. 45 50
14. Apparatus as claimed in Claim 13, wherein the storing means further includes means for storing information related to the history of the use of the target correlated with the information relating to the identity of the target. 55
15. Apparatus as claimed in Claim 14, wherein the apparatus further comprises means for performing a sputter coating process with the target in the sputtering chamber and means for updating the history of the target in accordance with the performance of the process therewith.
16. Apparatus as claimed in any one of claims 13 to 15, wherein the storing means further includes means for storing information related to the time of the use of the target correlated with the information relating to the identity of the target.
17. Apparatus as claimed in any one of Claims 12 to 16, wherein the medium is a read-write medium and the apparatus further comprises means for performing a sputter coating process with the target in the sputtering chamber and for logging a record of the occurrence of the process into the medium.
18. Apparatus as claimed in any one of Claims 12 to 17, wherein the information recorded on the medium is information relating to the composition of the target and the apparatus further comprises means for applying sputtering power to the target and means coupled to the reading means for controlling the power applying means in accordance with the information read from the medium.
19. Apparatus as claimed in any one of Claims 12 to 18, further comprising sputtering means for performing a sputter coating process with the target in the chamber, the sputtering means being coupled to the reading means to permit the sputtering means to control the process in accordance with the information read from the medium.
20. A method of manufacturing a sputter coated article comprising the steps of installing in a sputter coating chamber of a sputter coating apparatus a target of sputter coating material and performing a sputter coating process through the use of the target to deposit a coating of the sputter coating material on an article, characterised in that the target has a medium carrying machine readable information carried thereby and in that the method includes reading with a reader carried by the apparatus information from the medium and storing in a memory, information regarding the use of the target, the information including information read from the medium.
21. A method as claimed in Claim 20, wherein the reading step includes the step of reading in-



formation relating to the identity of the target.

22. A method as claimed in either Claim 20 or 21, wherein the reading step includes the step of reading information relating to the history of the use of the target.

23. A method as claimed in any one of Claims 20 to 22, wherein the reading step includes the step of reading information relating to the composition of the target.

24. A method as claimed in any one of Claims 20 to 23, further comprising the step of writing the stored information to a medium carried by the target.

25. A method as claimed in any one of Claims 20 to 24, further comprising the steps of writing the stored information to a machine readable medium and affixing the written medium to the target.

26. A method as claimed in any one of Claims 20 to 25, further comprising testing for information recorded on the medium and, if no information is recorded on the medium, prompting an operator to provide information regarding the use of the target.

27. A method as claimed in any one of Claims 20 to 26, wherein the stored information includes information of the energy consumed by the target during the sputtering therewith.

28. A method as claimed in any one of Claims 20 to 27, wherein the stored information of the energy consumed by the target during the sputtering therewith includes information of the power applied to the target and the amount of time during which the power is applied.

Patentansprüche

1. Verbrauchbares Target aus Sputter-Beschichtungsmaterial, dadurch gekennzeichnet, daß an dem Target ein Speichermedium befestigt ist, welches in maschinenlesbarer Form auf ihm aufgezeichnete Information bezüglich des Targets enthält.

2. Target nach Anspruch 1, in der die auf dem Medium aufgezeichnete Information Information bezüglich der Identität des Targets einschließt.

3. Target nach einem der Ansprüche 1 oder 2, in der die auf dem Medium aufgezeichnete Infor-

mation Information bezüglich der Zusammensetzung des Targets einschließt.

4. Target nach einem der vorstehenden Ansprüche, in der die auf dem Medium aufgezeichnete Information Information bezüglich der Historie des Targets einschließt.

5. Target nach einem der vorstehenden Ansprüche, in dem das Medium ein Lese-Schreib-Medium ist.

6. Target nach einem der Ansprüche 1 bis 4, in dem das Medium ein read-only-Medium ist.

7. Target nach einem der vorstehenden Ansprüche, in dem das Medium von dem Sputter-Beschichtungsmaterial getragen wird.

8. Target nach einem der Ansprüche 1 bis 7, weiterhin einen Targetträger enthaltend, an welchem das Sputter-Beschichtungsmaterial befestigt ist und welcher das Medium trägt.

9. Target nach Anspruch 8, in dem das Medium derart auf dem Targetträger angeordnet ist, daß auf ihm aufgezeichnete Information von einem Prozeß des LöSENS des Targets oder des Befestigens des Targets am Targetträger zerstört wird.

10. Target nach einem der Ansprüche 8 oder 9, bei dem der Targetträger derart an dem Target befestigt ist, daß das Target auf eine Threshold-Temperatur erhitzt werden muß, um das Target vom Targetträger zu lösen und bei dem das Medium thermisch lösbar ist und in ihm eingespeicherte Information bei oder unterhalb der Threshold-Temperatur gelöscht wird.

11. Target nach einem der Ansprüche 8 bis 10, bei dem das Medium auf der Rückseite des Targetträgers angeordnet ist und die Lesemittel hinter dem Targetträger angeordnet sind.

12. Sputter-Beschichtungsvorrichtung mit einer Struktur, welche eine Sputterkammer definiert, einem Target nach einem der Ansprüche 1 bis 11, welches in der Kammer gehalten wird und von der Struktur getragene Mittel, welche derart angeordnet sind, daß sie die Information vom Speichermedium lesen.

13. Vorrichtung nach Anspruch 12, bei der die auf dem Medium aufgezeichnete Information Information bezüglich der Identität des Targets ist und die Vorrichtung weiterhin an die Lesemittel gekoppelte Mittel zum Speichern von Informa-



tion bezüglich der Identität des Targets enthält.

14. Vorrichtung nach Anspruch 13, in der die Speichermittel weiterhin Mittel zum Speichern von Information bezüglich der Nutzungshistorie des Targets enthalten, korreliert mit der Information bezüglich der Identität des Targets. 5
15. Vorrichtung nach Anspruch 14, in der die Vorrichtung weiterhin Mittel zum Ausführen eines Sputter-Beschichtungsprozesses mit dem Target in der Sputterkammer enthält, und Mittel zum Aktualisieren der Historie des Targets in Übereinstimmung mit der Ausführung des Prozesses mit demselben. 10
16. Vorrichtung nach einem der Ansprüche 13 bis 15, in der die Speichermittel weiterhin Mittel zum Speichern von Information bezüglich der Benutzungsdauer des Targets enthalten, korreliert mit der Information bezüglich der Identität des Targets. 15
17. Vorrichtung nach einem der Ansprüche 12 bis 16, in der das Medium ein Lese-Schreib-Medium ist und die Vorrichtung weiterhin Mittel zum Ausführen eines Sputter-Beschichtungsprozesses mit dem Target in der Sputterkammer und zum Schreiben einer Aufzeichnung des Auftretens des Prozesses in das Medium enthält. 20
18. Vorrichtung nach einem der Ansprüche 12 bis 17, bei der die auf dem Medium aufgezeichnete Information Information bezüglich der Zusammensetzung des Targets ist und die Vorrichtung weiterhin Mittel zum Zuführen von Sputterenergie zum Target enthält und mit den Lesemitteln gekoppelte Mittel zum Steuern der Energiezufuhrmittel in Übereinstimmung mit der von dem Medium gelesenen Information. 25
19. Vorrichtung nach einem der Ansprüche 12 bis 18, weiterhin Sputtermittel zum Ausführen eines Sputter-Beschichtungsprozesses mit dem Target in der Kammer enthaltend, wobei die Sputtermittel mit den Lesemitteln gekoppelt sind, um es den Sputtermitteln zu erlauben, den Prozeß in Übereinstimmung mit der vom Medium gelesenen Information zu steuern. 30
20. Verfahren zu Herstellung eines sputterbeschichteten Gegenstandes mit den Schritten: Ein Target aus Sputter-Beschichtungsmaterial wird in einer Sputter-Beschichtungskammer einer Sputter-Beschichtungsanordnung installiert, ein Sputter-Beschichtungsprozeß wird 35

durch die Verwendung des Targets ausgeführt, um eine Beschichtung von Sputter-Beschichtungsmaterial auf einen Gegenstand zu bringen, dadurch gekennzeichnet, daß das Target ein Medium aufweist, welches maschinenlesbare Information trägt und daß das Verfahren einschließt, mit einem durch die Vorrichtung gehaltenen Leser Information von dem Medium zu lesen und in einem Speicher zu speichern, wobei die Information den Gebrauch des Targets betrifft und die Information Information einschließt, welche von dem Medium gelesen wurde.

21. Verfahren nach Anspruch 20, in dem der Leseschritt den Schritt einschließt, Information bezüglich der Identität des Targets zu lesen. 40
22. Verfahren nach einem der Ansprüche 20 oder 21, in dem der Leseschritt den Schritt einschließt, Information bezüglich der Historie des Gebrauchs des Targets zu lesen. 45
23. Verfahren nach einem der Ansprüche 20 bis 22, in dem der Leseschritt den Schritt einschließt, Information bezüglich der Zusammensetzung des Targets zu lesen. 50
24. Verfahren nach einem der Ansprüche 20 bis 23, weiterhin den Schritt enthaltend, die gespeicherte Information auf ein durch das Target getragenes Medium zu schreiben. 55
25. Verfahren nach einem der Ansprüche 20 bis 24, weiterhin die Schritte enthaltend, die gespeicherte Information in ein maschinenlesbares Medium zu schreiben und das beschriebene Medium an dem Target anzubringen.
26. Verfahren nach einem der Ansprüche 20 bis 25, weiterhin enthaltend, die auf dem Medium aufgezeichnete Information zu testen und, wenn keine Information auf dem Medium aufgezeichnet ist, einen Operator anzusprechen, um Information bezüglich des Gebrauchs des Targets zur Verfügung zu stellen.
27. Verfahren nach einem der Ansprüche 20 bis 26, in dem die gespeicherte Information Information bezüglich der durch das Target während des Sputterns verbrauchten Energie einschließt.
28. Verfahren nach einem der Ansprüche 20 bis 27, in dem die gespeicherte Information über die durch das Target verbrauchte Energie während des Sputterns mit demselben Information über die dem Target zugeführte Energie und



die Zeitdauer während derer die Energie zugeführt wurde einschließt.

Revendications

1. Une cible perdue en matériau de revêtement par pulvérisation, caractérisée en ce qu'elle est fixée sur un moyen de stockage sur lequel sont enregistrées, sous la forme de signes exploitables par la machine, des informations relatives à la cible. 5
2. Une cible selon la revendication 1, dans laquelle les informations enregistrées sur le moyen comprennent celles relatives à l'identification de la cible. 10
3. Une cible selon n'importe laquelle des revendications 1 ou 2, dans laquelle les informations enregistrées sur le moyen comprennent celles relatives à sa composition. 20
4. Une cible selon n'importe laquelle des revendications précédentes, dans laquelle les informations enregistrées sur le moyen comprennent celles relatives à l'historique de la cible. 25
5. Une cible selon n'importe laquelle des revendications précédentes dans laquelle le moyen est un moyen de lecture/écriture. 30
6. Une cible selon n'importe laquelle des revendications 1 à 4, dans laquelle le moyen est uniquement un moyen de lecture. 35
7. Une cible selon n'importe laquelle des revendications précédente dans laquelle le moyen est supporté par le matériau de revêtement par pulvérisation. 40
8. Une cible selon n'importe laquelle des revendications 1 à 7, comprenant de plus un support de cible fixé sur un matériau de revêtement par pulvérisation supportant le moyen. 45
9. Une cible selon la revendication 8, dans laquelle le moyen est disposé sur le support de cible de telle manière que les informations qui y sont enregistrées soient détruites par un procédé permettant soit d'enlever la cible soit de la fixer au support. 50
10. Une cible selon n'importe laquelle des revendications 8 ou 9, fixée sur un support de cible de manière à ce qu'elle doive être chauffée à différents paliers de température pour l'enlever du support alors que le moyen est effaçable à cause de la chaleur, et pour en effacer ses

informations lorsque ces paliers, ou des paliers inférieurs, sont atteints.

11. Une cible selon n'importe laquelle des revendications 8 à 10, dans laquelle le moyen est placé au dos du support de cible et les lecteurs derrière ce support.
12. Un appareil de revêtement par pulvérisation comportant une structure délimitant une chambre de pulvérisation, une cible selon n'importe laquelle des revendications 1 à 11 maintenue dans la chambre, et des moyens supportés par la structure et placés de manière à lire les informations présentes dans le moyen de stockage. 15
13. Un appareil selon la revendication 12, dans lequel les informations enregistrées sur le moyen sont relatives à l'identification de la cible et un appareil comprenant de plus des moyens couplés aux lecteurs en vue du stockage des informations relatives à l'identification de la cible.
14. Un appareil selon la revendication 13, dans lequel les moyens de stockage incluent les informations relatives à l'historique de l'utilisation de la cible et corrélativement celles relatives à son identification.
15. Un appareil selon la revendication 14, qui comprend les moyens de mener à bien un processus de revêtement par pulvérisation d'une cible située dans la chambre de pulvérisation et d'autres permettant la mise à jour de l'historique de la cible par rapport aux performances du procédé.
16. Un appareil selon n'importe laquelle des revendications 13 à 15 dans lequel des moyens stockent des informations relatives au temps d'utilisation de la cible corrélativement à celles relatives à son identification.
17. Un appareil selon n'importe laquelle des revendications 12 à 16 comprenant un moyen de lecture/écriture et d'autres permettant de mener à bien le procédé de revêtement par pulvérisation avec une cible située dans la chambre de pulvérisation et pour inscrire sur une liste un enregistrement de l'occurrence du procédé dans le moyen.
18. Un appareil selon n'importe laquelle des revendications 12 à 17, dans lequel les informations enregistrées sur le moyen sont relatives à la composition de la cible ainsi que des moyens



pour appliquer une puissance de pulvérisation à la cible, et d'autres couplés aux lecteurs pour commander cette application en fonction des informations lues sur le moyen.

19. Un appareil selon n'importe laquelle des revendications 12 à 18, comprenant des pulvérisateurs pour mener à bien le procédé de revêtement par pulvérisation avec la cible située dans la chambre, les pulvérisateurs étant couplés aux lecteurs pour leur permettre de commander le procédé en fonction des informations lues sur le moyen.

20. Une méthode de fabrication d'un article en revêtement pulvérisé comprenant les étapes d'installation dans la chambre de revêtement par pulvérisation d'un appareil de revêtement par pulvérisation d'une cible en matériau de revêtement par pulvérisation et d'essai d'un procédé de revêtement par pulvérisation en utilisant une cible qui opère le revêtement d'un article caractérisée en ce que la cible comporte un moyen comportant des informations lisibles en machine et en ce qu'elle inclue la lecture au moyen d'un lecteur des informations contenues dans l'appareil à partir du moyen, et leur stockage en mémoire, les informations étant relatives à l'utilisation de la cible et incluant celles lues sur le moyen.

21. Une méthode selon la revendication 20, dans laquelle l'étape de lecture comprend celle des informations relatives à l'identification de la cible.

22. Une méthode selon n'importe laquelle des revendications 20 ou 21 dans laquelle l'étape de lecture comprend celle des informations relatives à l'historique de l'utilisation de la cible.

23. Une méthode selon n'importe laquelle des revendications 20 à 22 dans laquelle l'étape de lecture comprend celle des informations relatives à la composition de la cible.

24. Une méthode selon n'importe laquelle des revendications 20 à 23, comprenant l'étape de l'écriture des informations stockées sur un moyen supporté par la cible.

25. Une méthode selon n'importe laquelle des revendications 20 à 24 comprenant les étapes d'écriture des informations stockées sur un moyen lisible par la machine et fixé à la cible.

26. Une méthode selon n'importe laquelle des revendications 20 à 25, comprenant l'essai des

informations enregistrées sur le moyen et, si aucune information n'est enregistrée, le déclenchement d'un opérateur servant à fournir les informations relatives à l'usage de la cible.

27. Une méthode selon n'importe laquelle des revendications 20 à 26, où les informations stockées comprennent celles relatives à l'énergie consommée par la cible durant la pulvérisation.

28. Une méthode selon n'importe laquelle des revendications 20 à 27 où les informations stockées relatives à l'énergie consommée par la cible durant la pulvérisation incluent celles relatives à la puissance appliquée à la cible et à la durée total de cette application.

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