Method for Determining Parameter Distributions of Object Properties

The present invention relates to a method for determining parameter distributions of object properties, particularly substrate properties, that are obtained when objects or substrates are treated by at least two treatment processes.

Methods of this type are required and employed, for example, during the treatment of semiconductor substrates, especially wafers. For instance, the wafer is implanted with ions in a first treatment process. In a subsequent second treatment process the wafer is heated in a thermal treatment process, for example, in a so-called RTP (rapid thermal processing) system.

As wafer size increases and the dimensions of structures on the wafer decrease, the demands placed on the homogeneity of the physical parameters of the wafer, for example, film resistance or thickness, increase. For this reason it is necessary to calculate separately the effects that the implantation process and the thermal treatment process in the RTP system have on the homogeneity of the physical parameters to be measured. This allows the treatment processes to be optimized so that the homogeneity of the resulting wafer parameters is enhanced.

Separately calculating the effects of the individual treatment processes on the homogeneity of the physical parameters has often not

been possible in the past because it has not been possible to measure separately the factors that contribute to inhomogeneity of the physical parameters, which factors are caused by the implantation process and the process in the RTP system. Therefore, in such cases in the past it has not been possible to optimize the individual treatment processes with respect to the homogeneity of the physical parameters.

Known from DE 197 09 348 is an automated method for determining and mapping any desired number of molecules, parts of molecules, or groups of molecules in objects for employment in research in the fields of cancer and immunology. The objects examined are solid or liquid objects. The samples are not in different positions, but rather are positioned as near as is possible in exactly the same position. This process cannot be employed to calculate parameter distributions of objects after they have undergone treatment processes.

DE 38 36 716 relates to a method for evaluating cell images in which digital images of an image field are displayed chronologically on the screen and the cells are marked in the image field in order to calculate from the stored number and position of the marks statistical figures that characterize the cells.

The object of the present invention is to provide methods with which it is possible to determine separately the effects of individual

treatment processes on parameter distribution.

This object is achieved in accordance with the present invention in that parameter distributions of at least two objects are calculated after they have undergone at least two treatment processes, whereby during at least one treatment process at least one object is positioned differently with respect to at least one other object. With this method it is possible to determine the effects of the individual treatment processes on parameter distribution so that from this information it is possible, for example, to optimize the treatment processes. If the treatment processes are, for example, the implanting process for a wafer and the subsequent process in an RTP system, the separation method in accordance with the present invention can determine separately for each treatment process the effects of these treatment processes on the homogeneity of a physical parameter. Thus it is possible from this information to optimize the treatment processes with respect to the homogeneity of this physical parameter.

In accordance with one advantageous embodiment of the present invention, the parameter distributions of the differently positioned objects are determined with the same method of measurement. In particular, the objects should be measured in the same direction and at the same points of measurement. This obtains comparable measurement results for all

objects and prevents individual false readings in the measurement results for each object caused by the measurement process. However, different measurement directions and measurement grids can also be used if these are then converted using mathematical processes.

Preferably the method in accordance with the present invention is employed when two-dimensional or three-dimensional parameter distributions are to be determined, as is the case, for example, during the manufacture of integrated circuits on wafers.

In accordance with one advantageous embodiment of the invention, inhomogeneities in properties of the object are calculated by the parameter distributions. The objects are, for example, semiconductor substrates, especially wafers. The object properties are, for example, film resistance or the film thickness on a wafer calculated therefrom. In the case of manufacturing semiconductor chips from wafers, the wafer treatment processes affect the homogeneity of the physical and chemical parameters. The treatment processes encompass, for example, an implantation process for a wafer and a subsequent thermal treatment process in an RTP system. In this case the method in accordance with the present invention can be used to separate the effects of the implantation process on, for example, the homogeneity of the film properties from the effects of the thermal treatment process.

The parameter distributions are measured, for example, with ellipsometers, four-pointed measuring devices, and/or eddy-current measuring equipment.

It is necessary that at least two semiconductor substrates be rotated by an angle relative to one another when the method in accordance with the present invention is employed.

The advantages of this method are evident in the preferred exemplary embodiments described hereinafter.

If one treatment process does not affect the object properties, i.e. the parameter distributions, in a rotationally symmetrical manner, this effect is preferably determined by the separation method. However, if they are affected in a rotationally symmetrical manner, this effect is preferably determined by a subtraction method. The advantages of this approach are also evident in the following description of the method in accordance with the invention, using concrete applications.

The invention is explained in detail in the following using preferred exemplary embodiments and special applications in the semiconductor industry and using Figures 1 through 4, wherein.

Fig. 1 illustrates how individual factors are overlaid for measured parameter distribution;

Fig. 2 illustrates different positioning of wafers in an RTP

system;

Fig. 3 presents examples for artificially pre-specified effects caused by an implantation process for a wafer and by a subsequent thermal treatment process in an RTP system and also illustrates the method steps in accordance with the invention using these examples to test the method in accordance with the invention; and,

Fig. 4 illustrates experimental examples for explaining the method in accordance with the invention.

The method in accordance with the present invention is explained in the following using the example of treating wafers for manufacturing semiconductor chips.

During the manufacturing process, the wafer undergoes an implantation process in which ions are implanted in the wafer. Then the wafer is introduced into a so-called RTP (rapid thermal processing) system in order to be heated therein.

After the wafer has undergone both the implantation process and the thermal treatment process in the RTP system, for example, the film thickness or film resistance across the entire surface of the wafer, is measured using, for example, ellipsometers or four-pointed measuring

devices in order to determine therefrom the distribution of the film properties across the surface of the wafer. As the diameter of wafers increases (and today they are already 150 mm, 200 mm, or even 300 mm in diameter) and the dimensions of the structures on the wafer decrease (for example, in the range of 0.25 μm, 0.18 μm, or even 0.13 μm), commensurately high demands are placed on the homogeneity of the properties of the film across the surface of the wafer. In order to meet these increased demands on the homogeneity of the films, it is important to determine independently of each other the different source factors in each of the treatment processes that affect the homogeneity of the film thickness. One element that determines the final film homogeneity is inhomogeneities that are caused by all of the processes employed on the wafer prior to the thermal treatment process in the RTP system – referred to hereinafter as pre-process inhomogeneity. However, the homogeneity of the film properties is also affected by the thermal treatment process in the RTP system itself. This effect is referred to hereinafter as RTP inhomogeneity. If the pre-process effects and the RTP system effects on the inhomogeneity of the film are known independently of each other, both the pre-process and the thermal treatment process in the RTP system can be optimized with respect to improving the homogeneity of the film properties. However, in practice it is not possible to directly

measure the film properties after the implantation process and prior to the thermal treatment process.

In accordance with one separation method in accordance with the present invention, both the pre-process inhomogeneity and the RTP inhomogeneity are determined separately from a distribution of film properties X, which can be measured, for example, with ellipsometers, four-pointed measurement devices, and other measuring equipment. The measured distribution of the film properties X can in general be divided into four factors. The first factor is the mean or the mean distribution, i.e. the homogeneous mean M of the measured distribution X. The second factor P represents the effect of all processes that the wafer has undergone prior to the thermal treatment process on the distribution of the film properties X. Thus P characterizes the pre-process inhomogeneity or distribution. The third factor T represents the effect of the thermal treatment process, i.e. the effect the thermal treatment process has on the distribution of the film properties X. T thus characterizes the RTP inhomogeneity or process distribution. The fourth factor Δ takes into account the statistical deviations of the measurements that are caused by the measurement processes.

Assuming that the pre-process inhomogeneities and RTP inhomogeneities overlap, the following equation results:

$$X = M + P + T + \Delta \qquad (1)$$

Figure 1 also provides a graphic representation of the overlapping of the individual factors as set forth by this equation for measuring the distribution of film properties X.

The following conditions are assumed for the method in accordance with the present invention described hereinafter:

1. The pre-processes are identical for all wafers (for example, identical initial wafers, identical wafer layout, and identical implantation system);
2. All wafers are treated with the same thermal treatment process in the RTP system;
3. The processed wafers are arranged in the implanter or in the RTP system, for example, with different angles of rotation α, which can be a fraction of 360°, i.e. multiples of such a fraction, for example, 45°, 60°, or 90°. Other geometric operations are also possible, for example, mirror-imaging;
4. All wafers are measured in the measuring equipment with the same alignment of the markings (also called "notches" or "flats"), or the parameter distributions are rotated appropriately by computation.

A generalization of the aforesaid requirements for film thickness

distributions on general data sets leads to the following conditions:

1.' Identical pre-processes for all data sets to be analyzed and the pre-processes are identical and reproducible (identical input data sets);

2.' The subsequent process is identical for all data sets to be analyzed;

3.' The input data sets are oriented differently during the pre-process or the subsequent process; and,

4.' Identical measuring process for all data sets, especially identical orientation of the data sets during the measurement or computational/mathematical conversion thereof.

The reasons for requirements 1 through 4 and 1.' through 4.' cited above are evident from the following description of the method in accordance with the invention.

Figure 2 illustrates the alignment of, for example, the wafer to be processed in the RTP system at the different alignment angles $\alpha = 0°$, 90°, and 180° in accordance with requirement 3. The wafers are introduced into the RTP system 4 mutually rotated with respect to the illustrated wafer 1. The rotation of the wafers 1, 2, and 3 relative to one another is evident from the different alignment of the notch 5.

Only two wafers that are processed under the conditions above are required for the method in accordance with the present invention. However, it is also possible to employ more wafers in order to average

the results of different measurements to reduce statistical deviations. When two measured film property distributions X_1 and X_2 are used, the equation (1) leads to the following equations (2a) and (2b).

$$X_1 = M_1 + P_1 + T_1 + \Delta_1 \qquad (2a)$$

$$X_2 = M_2 + P_2 + T_2 + \Delta_2 \qquad (2b)$$

Both distributions of the film properties X_1 and X_2 comprise the four factors M, P, T, and Δ, which factors can, however, be different for each of the two wafers.

Taking into consideration requirements 1 and 2 above, it is found that the means M_1 and M_2 and the pre-process inhomogeneities P_1 and P_2 must be the same because these requirements require repeatable wafer pre-processing and repeatable wafer processing in the RTP system.

Thus:

$$M_1 = M_2 = M \qquad (3a)$$

$$P_1 = P_2 = P \qquad (3b)$$

It follows from requirements (2) and (3) that the RTP inhomogeneities T_1 and T_2 differ from each other only in that they are rotated relative to one another by an angle of $-\alpha$. Thus,

$$T_1 = T \qquad (3c)$$

$$T_2 = (T_1)_R = (T)_R \qquad (3d)$$

This Sheet Has Been Replaced



This Sheet Has Been Replaced

$(T)_R$ thus characterizes the rotation of the RTP inhomogeneity T by the angle $-\alpha$.

Equations (2a) and (2b) can be simplified to equations (4a) and (4b) using equations (3a) through (3d):

$$X_1 = M + P + T + \Delta_1 \qquad (4a)$$

$$X_2 = M + P + (T)_R + \Delta_2 \qquad (4b)$$

In this exemplary embodiment, equations (4a) and (4b) are the initial equations, the separate determination of the pre-process inhomogeneity P and the RTP inhomogeneity T.

For determining the RTP inhomogeneity T, the pre-process inhomogeneity P is eliminated from equations (4a) and (4b) in that one equation is subtracted from the other. This results in the equation:

$$X_1 - X_2 = T - (T)_R + \Delta_1 - \Delta_2 \qquad (5)$$

It is furthermore assumed that the statistical deviations Δ_1 and Δ_2, or the difference between Δ_1 and Δ_2, are minor relative to T and $(T)_R$ and can be considered negligible. Thus:

$$T - (T)_R \approx X_1 - X_2 \qquad (6)$$

The RTP inhomogeneity T is obtained from Equation (6) using matrix operations MO:

$$T \approx RTP - MO\,(X_1 - X_2) \qquad (7)$$

For determining the pre-process inhomogeneity P, the RTP

inhomogeneities are now eliminated from Equations (4a) and (4b). For this reason the measured film thickness distribution X_2 is computationally returned by rotating by the angle α. This return rotation is characterized by the index -R. Thus the following equation:

$$(X_2)_{-R} = (M)_{-R} + (P)_{-R} + T + (\Delta_2)_{-R} \quad (8)$$

If it is now taken into account that the mean distribution M is a homogeneous distribution, then:

$$(M)_{-R} = M \quad (9)$$

so that it follows that

$$(X_2)_{-R} = M + (P)_{-R} + T + (\Delta_2)_{-R} \quad (10)$$

Subtracting Equation (10) from Equation (4a) eliminates the RTP inhomogeneity. Thus:

$$X_1 - (X_2)_{-R} = P - (P)_{-R} + \Delta_1 - (\Delta_2)_{-R} \quad (11)$$

When the difference between the two statistical deviations Δ_1 and $(\Delta_2)_{-R}$ is small, it can be considered negligible. Thus:

$$P - (P)_{-R} \approx X_1 - (X_2)_{-R} \quad (12)$$

The pre-process inhomogeneity P can now be calculated by means of a corresponding matrix operation:

$$P \approx \text{Pre-process-MO}\ (X_1 - (X_2)_{-R}) \quad (13)$$

Thus Equations (7) and (13) are used separately with the method described in the foregoing to obtain the RTP inhomogeneity T and the

pre-process inhomogeneity P. Therefore the pre-processes, for example, the implantation process, and the thermal treatment process in the RTP system can be optimized in a targeted and mutually independent manner with respect to improving the homogeneity of the film properties.

The inventive separation method was tested using three different tests.

In a first test, two different gradient distributions were pre-specified as pre-process inhomogeneity P and as RTP inhomogeneity T. The film thickness distribution X_1 was produced using Equation (4a) by artificially overlaying the gradient distribution P and the gradient distribution T. Analogously, the film thickness distribution X_2 was artificially produced using Equation (4b) after computationally rotating the gradient distribution T by an angle α. The mean M and the statistical deviations Δ_1 and Δ_2 do not have to be pre-specified because they will be eliminated or considered negligible in the subsequent method steps. Then film thickness distribution X_1 was subtracted from X_2 according to Equation (6). Then the system inhomogeneity T was calculated using Equation (7). It was demonstrated that the calculated RTP inhomogeneity T was a good match to the pre-specified and thus known RTP inhomogeneity T.

For calculating the pre-process inhomogeneity P, the film thickness distribution X_2 was computationally or mathematically rotationally returned

using Equation (8) and subtracted from Equation (4a). The pre-process inhomogeneity was then calculated using Equation (13). Again, it was demonstrated that the pre-process inhomogeneity P was a good match to the pre-specified pre-process inhomogeneity. This test thus demonstrated the correctness of the method in accordance with the invention for gradient distribution for the pre-process inhomogeneity and for RTP inhomogeneity.

In a second test, a gradient distribution was pre-specified for the pre-process inhomogeneity P and a rotation-symmetrical distribution was pre-specified for the RTP inhomogeneity T. Again, the gradient distribution for the pre-process inhomogeneity P could be reproduced with no problem. However, the rotation-symmetrical distribution for the RTP inhomogeneity T could not be reproduced in accordance with expectations. This can be explained, for example, using Equation (6). In Equation (6), the RTP inhomogeneity, which is rotated by the angle -α, of the second wafer $(T)_R$, which is rotated by the angle -α, is subtracted from the system inhomogeneity T of the first wafer. However, since rotation-symmetrical distributions are invariant relative to rotations, the difference in this subtraction equation is zero. In this case the matrix operations RTP-MO fail.

An additional subtraction method is used for overcoming this

problem; in this method, the gradient distribution, calculated using the separation method in accordance with the invention, for the pre-process inhomogeneity P is subtracted from the second film property distribution X_2 given in Equation (4b). Then the resulting distribution X_2 - P is computationally rotationally returned by the angle α. The result of this subtraction process is:

$$(X_2 - P)_{-R} = M + T + (\Delta_2)_{-R} \qquad (14)$$

The advantage of Equation (14) is that it includes both the mean distribution M and the RTP inhomogeneity T. Thus the real value of the mean M can be compared to the RTP inhomogeneity. The statistical deviations $(\Delta_2)_{-R}$ can again be considered negligible. Since the mean M can be calculated from the measured values for the film thickness distribution, Equation (14) permits the use of the RTP inhomogeneity T.

The subtraction method can also be employed when the pre-process inhomogeneity P is a rotation-symmetrical distribution. Naturally this subtraction method can also be used for all other types of distributions when the real value of the mean M is to be compared to the pre-process inhomogeneity P, i.e. to the RTP inhomogeneity T.

In a third test, a real distribution was assumed for RTP inhomogeneity T and a gradient distribution was assumed for pre-process inhomogeneity P, as shown in Figures 3a and 3b. These are examples

for initial distributions for the film thickness that were used to test the separation method in question. The mean M is also given in Figure 3b. Inhomogeneities P and T are represented by σ. For artificially producing the film thickness distribution X_1, inhomogeneities P and $(T)_{-R}$ were added or overlaid assuming an alignment angle of $\alpha = -90°$, as shown in Figure 3c. Thus, in this case the RTP inhomogeneity T was rotated mathematically by -90° in advance. For artificially producing the second layer thickness distribution X_2, the inhomogeneities P and T were added or overlaid assuming an alignment angle of $\alpha = 0°$, as shown in Figure 3d. Then the pre-process inhomogeneity P and the RTP inhomogeneity T were calculated using the separation method in accordance with the present invention. The results are shown in Figures 3e and 3f and indicate very good reproduction of the pre-process inhomogeneity P and acceptable reproduction of the RTP inhomogeneity T. Finally, the RTP inhomogeneity T was also determined using the film resistance distribution shown in Figure 4c and the pre-process distribution illustrated in Figure 4d with the subtraction method described above. Figure 3g illustrates the result of this calculation. Comparing these results to the pre-specified RTP inhomogeneity T in Figure 3b results in a very good match in both distributions.

The third test described in the foregoing was conducted for

This Sheet Has Been Replaced

different alignment angles α, although the results are only provided for α = 90°. It was demonstrated that small differences in the alignment angles of the wafer should be preferred. Rotations of 180° lead to unnecessary losses of information for the solution algorithms. These losses of information are based on the mathematical problem for the matrix operations and cannot be overcome.

The method in accordance with the present invention was also employed for measuring film resistance after 200-mm wafers were implanted (As^+, 30keV, $1E16cm^{-2}$). These wafers were treated at 1050° C for 30 seconds at various alignment angles in an AST 2800ε RTP system belonging to STEAG AST Elektronik GmbH. Figures 4a through 4c illustrate the measured film resistance distributions at alignment angles α = 90°, α = 152°, and α = 180°. Since the mean distributions for the film resistance distributions indicated only minor differences (49.81 to 50.08 Ohm/□), all film resistance distributions were standardized to the mean of 100 Ohm/□. The separation method in accordance with the invention was then used on the standardized film thickness distributions for 90° and 180°. Figures 4d and 4e illustrate the calculated pre-process inhomogeneity and the calculated RTP inhomogeneity. The calculated pre-process inhomogeneity is a good match with inhomogeneities to be assumed due to industrial processes. The pre-process (implantation) and

(RTP) process distributions were also calculated using the presented separation method using the measurement data in 4a and 4c. In addition, the subtraction method for calculating the RTP inhomogeneity T was applied to the film resistance distributions. Furthermore, the pre-process inhomogeneity P already calculated was subtracted from the film resistance distributions (Fig. 4a - c), according to Equation (14). First the subtraction method was applied to the film resistance distributions for $\alpha = 90°$ and $\alpha = 180°$. The results are illustrated in Figures 4f and 4h. The process distributions were calculated using the presented subtraction method for different positioning angles α (after standardization of the measurement data distributions) using the calculated pre-process distribution (Fig. 4d). As can be seen in these figures, the corresponding calculated RTP inhomogeneities were approximately the same size. The reason for this is that the pre-process inhomogeneity P was calculated from these two film resistance distributions. If the theory is correct, the subtraction method used for both wafers must lead to the same results. The subtraction method was then applied to the film resistance distribution for $\alpha = 152°$ in order to examine the results. The result of this operation could not be predicted since the film resistance distribution for 152° was not used earlier to calculate the pre-process inhomogeneity P. The calculation result shown in Figure 4g is very similar to the previously

calculated RTP inhomogeneities for $\alpha = 90°$ and $\alpha = 180°$.

The invention was previously [sic] using preferred embodiments. However, it would be possible for one skilled in the art to undertake alterations, embodiments, and modifications without departing from the inventive thought. For instance, not only is it possible to measure two objects or wafers arranged in different positions, but it is also possible to do so with three or more objects. In addition, the method in accordance with the invention can also be used for applications in the semiconductor industry other than those described in the foregoing, and can be used with the same advantages, for example, in connection with crystal-pulling processes and thus in connection with both prior and subsequent treatment processes.

An example of additional applications of the invention is employment during the production of compound semiconductors, for example, for constructing optoelectronic components such as, for example, laser diodes, which are used, for example, in modern DVD (digital versatile disc) read/write devices.

Films that form a III-V (for example, GaN) or II-VI semiconductor film are separated using MOCVD (metalorganic chemical vapor deposition) or HVPE (hydride vapor phase epitaxy) on a base that is used as a carrier or substrate, for example, sapphire. The term substrate in

general includes both the carrier and the film or a system of films, for example, also a stand-alone substrate if the sapphire carrier is removed. Film systems with different film compositions can be produced by means of the cited method, especially films that contain acceptors such as, for example, Mg. In general the acceptor atoms must be activated inside the film by an activation method since they are passivized with hydrogen due to complexing. Activation methods used include, for example, thermal methods such as, for example, RTP methods.

The production of semiconductors thus includes different film-formation and activation steps. The present invention can be used for determining the parameter distributions during or after the individual steps, for example, for determining the homogeneity of the film formation or the homogeneity of the activation. This makes it possible to test, for example, MOCVD and HVPE systems in terms of their deposit behavior. This is particularly advantageous when different gas systems are used for different films, since in such cases in general identical film formation conditions cannot be assumed. Thus it becomes possible to optimize the gas systems using the present invention. Likewise, the homogeneity or parameter distribution of the active acceptors can also be determined, whereby the method in accordance with the invention can be employed not only during thermal activation using RTP systems or hot wall reactors,

but also, for example, during all other pertinent activation methods, for example, activation by means of minority charge carrier injection (see also M. Miyachi, et. al., Applied Physics Letters, Vol. 72, No. 9 (1999), pages 1101 - 1103).

The present invention can also be used advantageously for testing parameter distributions during the deposition of film or multi-film systems, for example, during application of BST (barium/strontium titanate), PZT (lead/zircon titanate) or SBT (strontium/bismuth titanate) to substrates.

An additional example of how the present invention can be employed is to calculate the parameter distributions of carrier or film properties during the production, for example, of data carrier CDs (for example, music CDs or CD ROMs).

This Sheet Has Been Replaced

Patent claims

1. Method for determining parameter distributions of substrate properties that are obtained when substrates are treated by at least two treatment processes, characterized in that parameter distributions of at least two substrates are calculated after they have undergone at least two treatment processes, whereby during at least one treatment process at least one substrate is positioned differently with respect to at least one other substrate.

2. Method in accordance with claim 1, characterized in that the parameter distributions obtained for at least two substrates are used to determine the effects of at least one treatment process on the parameter distributions separately from the effects of the other treatment processes.

3. Method in accordance with any of the foregoing claims, characterized in that the information about the effects of the separate treatment processes is used for optimizing the individual treatment processes.

4. Method in accordance with any of the preceding claims, characterized in that the parameter distributions of differently positioned substrates are determined with measurement methods.

5. Method in accordance with any of the preceding claims, characterized in that any desired arrangement of measurement points

* C L M S *

This Sheet Has Been Replaced

can be selected.

6. Method in accordance with any of the preceding claims, characterized in that the parameter distributions are two- or three-dimensional.

7. Method in accordance with any of the preceding claims, characterized in that inhomogeneities in the substrate properties are calculated by the parameter distributions.

8. Method in accordance with any of the preceding claims, characterized in that the parameter distributions are measured with an ellipsometer and/or with a four-pointed measuring device.

9. Method in accordance with any of the preceding claims, characterized in that the substrates are semiconductor substrates or magnetic substrates.

10. Method in accordance with any of the preceding claims, characterized in that the treatment processes include an implantation process and one subsequent treatment process.

11. Method in accordance with claim 10, characterized in that the effects of the implantation process on the substrate properties are separated from the effects of the subsequent treatment process.

12. Method in accordance with any of the preceding claims, characterized in that the treatment processes include a crystal-pulling

* C L M S *

This Sheet Has Been Replaced

process and one subsequent treatment process.

13. Method in accordance with claim 12, characterized in that the effects of the crystal-pulling process on the substrate properties are separated from the effects of the subsequent treatment process.

14. Method in accordance with any of claims 9 through 13, characterized in that at least two semiconductor substrates or magnetic substrates are rotated by an angle relative to one another.

15. Method in accordance with any of the preceding claims, characterized in that the substrate properties are the film resistance and/or other film properties and/or material properties and/or magnetic properties.

16. Method in accordance with any of the preceding claims, characterized in that a subtraction process is used to calculate a rotation-symmetrical effect on the substrate properties.

17. Method in accordance with any of claims 1 through 9, characterized in that the treatment processes include an MOCVD or HVPE process and one subsequent treatment process.

18. Method in accordance with claim 17, characterized in that the effects of the MOCVD or HVPE process on the substrate properties are separated from the effects of the subsequent treatment process.

19. Method in accordance with any of claims 10 through 18,

* C L M S *

characterized in that the subsequent treatment process includes a thermal treatment process in an RTP system.

20. Method in accordance with claim 19, characterized in that the effects of the RTP system on the substrate properties can be separated independently from the previous treatment process.

21. Method for determining parameter distributions of object properties that are obtained when objects are treated by at least two treatment processes, characterized in that the parameter distributions of at least two mutually independent objects are calculated after they have undergone at least two treatment processes, whereby during at least one treatment process at least one object is positioned differently with respect to at least one other object for determining the parameter distribution.

This Sheet Has Been Replaced



