WAFER DICING METHOD, DICING MACHINE, AND STORAGE MEDIUM

[0001] This application claims the priority to Chinese Patent Application No. 202211641378.0, titled "WAFER DICING METHOD, DICING MACHINE, AND STORAGE MEDIUM", filed on December 20, 2022 with the China National Intellectual Property Administration, which is incorporated herein by reference in its entirety.

FIELD

[0002] The present disclosure relates to the field of product processing, and in particular to a method for dicing a wafer, a dicing machine, and a storage medium.

BACKGROUND

[0003] In the process of dicing a wafer by a dicing machine, the wafer is physically diced by a disc-like blade wheel mounted on a dicing blade. A double-dicing mode is a common dicing mode in a double-shaft dicing machine. Specifically, a scribe line is diced twice sequentially by two dicing blades, in order to dice through the wafer. In the double-dicing mode, dicing blades with different specifications may be selected to complete the two dicing processes for the same scribe line. For example, in a case that the materials of a surface layer and a deep layer of the wafer are different, the dicing blades suitable for dicing respective materials are selected to dice the same scribe line sequentially to complete dicing.

[0004] However, in the process of wafer dicing, the scribe line is often sampled for detecting, in order to detect whether there is an offset in the diced scribe line. If there is an offset, it is necessary to correct the scribe line, to prevent an error in the subsequent dicing.

[0005] In the double-dicing mode, when the sampling occurs after the first dicing of a scribe line and before the second dicing of the scribe line, if an offset of the scribe line is detected, the scribe line is calibrated immediately based on the detection result. At this time, if it continues to perform the second dicing of the double-dicing mode, the second dicing is performed along the calibrated scribe line. Since the specification of the dicing blade for performing the second dicing may differ from the specification of the dicing blade for performing the first dicing, and the materials suitable for the first dicing and the second dicing are also different, when the dicing is performed again after the scribe line calibration, the

dicing blade for the second dicing will dice the wafer at a position which has not been subjected to the first dicing. At this time, the dicing blade for the second dicing will dice the surface material that is not suitable for this dicing blade to dice, which not only affects the quality of the wafer dicing, but also may cause the dicing blade to be damaged or even chipped, reducing the dicing efficiency.

SUMMARY

[0006] In view of this, a method for dicing a wafer, a dicing machine, and a storage medium are provided according to embodiments of the present disclosure, to reduce the impact on dicing caused by the calibration of the scribe line performed during two dicing processes of a same scribe line in a double-dicing mode, so as to successfully complete the dicing processes.

[0007] In a first aspect, a method for dicing a wafer is provided according to an embodiment of the present disclosure. The method is applied to a dicing machine, where the dicing machine dices the wafer in a double-dicing mode in which the dicing machine sequentially dices a same scribe line by two dicing blades, and method includes:

[0008] dicing the current scribe line by a first dicing blade, to form a first dicing mark;

[0009] if, before dicing the current scribe line by a second dicing blade, a dicing-mark detection is performed and an offset between the first dicing mark and a preset dicing position for the current scribe line is obtained, dicing the current scribe line by the second dicing blade with the offset being ignored during the dicing by the second dicing blade; and

[0010] after the dicing of the current scribe line by the second dicing blade, calibrating a dicing position for a next scribe line based on the offset.

[0011] In an embodiment, the dicing-mark detection performed on the current scribe line includes the following steps:

[0012] driving a camera to move to and take a photo of the current scribe line, where a drive mechanism for driving a relative motion between the camera and a carrier for carrying the wafer is preconfigured so that, when the camera takes a photo of a scribe line, a reference line of the camera is located within the scribe line, and the reference line is configured to mark a preset dicing-mark position of the scribe line; and

[0013] determining the offset based on a distance between the reference line of the camera and the first dicing mark.

[0014] In an embodiment, the determining the offset based on the distance between the reference line of the camera and the first dicing mark specifically includes:

[0015] controlling the camera to move from a preset dicing-mark position of the current scribe line, such that the reference line of the camera is moved towards the first dicing mark until the first dicing mark coincides with the reference line of the camera; and

[0016] acquiring a distance by which the camera is moved from the preset dicing-mark position of the current scribe line towards the first dicing mark, and determining the distance as the offset.

[0017] In an embodiment, the calibrating the dicing position for the next scribe line based on the offset specifically includes:

[0018] after the first dicing blade and the second dicing blade dice the current scribe line, performing, based on a preset distance between the current scribe line and the next scribe line and the offset, a mathematical operation using the offset and the preset distance to determine a distance between the current scribe line and a preset dicing-mark position of the next scribe line, and calibrating the dicing position for the next scribe line based on the distance.

[0019] In an embodiment, the wafer has a plurality of scribe lines, and the method further includes:

[0020] obtaining the number of scribe lines that have been diced by the first dicing blade and/or the number of scribe lines that have been diced by the second dicing blade, and triggering the dicing-mark detection each time dicing of a preset number of scribe lines is completed.

[0021] In an embodiment, the first dicing blade and the second dicing blade have different specifications.

[0022] In an embodiment, the first dicing blade and second dicing blade have the same specifications.

[0023] In a second aspect, a dicing machine is provided according to an embodiment of the present disclosure. The dicing machine includes a detecting module, a dicing module, and a

processor.

[0024] The dicing module includes two dicing blades.

[0025] The detecting module is configured to perform a dicing-mark detection on a current scribe line and obtain an offset between a first dicing mark and a preset dicing position of the current scribe line.

[0026] The dicing module is configured to: when the dicing machine dices a wafer in a double-dicing mode, sequentially dice a same scribe line by the two dicing blades.

[0027] The processor is configured to: if, before dicing the current scribe line by a second dicing blade, the dicing-mark detection is performed and the offset between the first dicing mark and the preset dicing position of the current scribe line is obtained by the detecting module, control the second dicing blade to dice the current scribe line with the offset being ignored during the dicing by the second dicing blade; and, after the dicing of the current scribe line by the second dicing blade, calibrate a dicing position for a next scribe line based on the offset.

[0028] In an embodiment, the detecting module includes a camera, and the detecting module is specifically configured to:

[0029] drive the camera to move to and take a photo of the current scribe line, wherein a drive mechanism for driving a relative motion between the camera and a carrier for carrying the wafer is preconfigured so that, when the camera takes a photo of a scribe line, a reference line of the camera is located in a range of the scribe line, and the reference line is configured to mark a preset dicing-mark position of the scribe line;

[0030] determine the offset based on the distance between the reference line of the camera and the first dicing mark; and

[0031] after the first dicing blade and the second dicing blade dice the current scribe line, perform, based on a preset distance between the current scribe line and the next scribe line and the offset, a mathematical operation using the offset and the preset distance to determine a distance between the current scribe line and a preset dicing-mark position of the next scribe line, and calibrate the dicing position for the next scribe line based on the distance.

[0032] In a third aspect, a computer storage medium is provided according to an embodiment of the present disclosure. The computer storage medium stores codes. The codes,

when being executed by a device, cause the device to perform the method according to any of the aforementioned first aspect.

[0033] A method for dicing a wafer, a dicing machine, and a storage medium are provided according to the present disclosure. The method is applied to a dicing machine, where the dicing machine dices the wafer in a double-dicing mode in which the dicing machine sequentially dices a same scribe line by two dicing blades. Firstly, a scribe-line detection is performed on the current scribe line to acquire a detection result. It is then determined whether both of the two dicing blades have completed respective dicing processes of the current scribe line. If both of the two dicing blades have completed the respective dicing processes of the current scribe line, a next scribe line is calibrated based on the detection result. If the second dicing of the current scribe line has not been started, the next scribe line is calibrated based on the detection result after both of the two dicing blades have completed the respective dicing processes of the current scribe line. In this way, the second dicing on the same scribe line may be prevented from being affected by the offset detected in the dicing-mark detection. Further, whenever the dicing-mark detection is triggered, it can be ensured that dicing positions of two successive dicing processes on the same scribe line are overlapped with each other, so as to avoid the adverse effect on the quality of the dicing and on the dicing blades.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] Hereinafter drawings to be applied in embodiments or in the conventional technology are briefly described, in order to clarify illustration of technical solutions according to embodiments of the present disclosure or in conventional technology. Apparently, the drawings in the following descriptions are only some embodiments of the present disclosure, and other drawings may be obtained by those skilled in the art based on the provided drawings without exerting creative efforts.

[0035] FIG. 1 is a schematic diagram of wafer dicing;

[0036] FIG. 2 is a schematic diagram of a double-dicing mode;

[0037] FIG. 3 is a flowchart of a method for dicing a wafer;

[0038] FIG. 4 is a flowchart of a method for detecting a dicing mark;

[0039] FIG. 5 is a flowchart of a method for determining an offset;

[0040] FIG. 6 is a schematic diagram of the determined offset; and

[0041] FIG. 7 is a structural schematic diagram of a dicing machine.

DETAILED DESCRIPTION

[0042] During research in the prior art , it was found that in the process of dicing a wafer by a dicing machine, the wafer is physically diced by a disc-like blade wheel mounted on a dicing blade. FIG. 1 is a schematic diagram of wafer dicing. In the scene shown in the figure, a dicing blade 101 is used for dicing a wafer 102.

[0043] The dicing blade 101 may be a hard blade or a soft blade. For example, a metal dicing blade, a resin dicing blade, an electroformed dicing blade are soft blades, and an electroformed hub-type dicing blade is a hard blade. The metal dicing blade is suitable for precise dicing and slotting processing of electronic components, optical elements and the like. The resin dicing blade is suitable for processing various encapsulation materials, and difficult-to-process materials represented by glass and crystalline materials. The electroformed dicing blade is suitable for dicing and slotting of compound semiconductors, silicon wafers and ceramic electronic components. The electroformed hub-type dicing blade may perform highly difficult chamfer dicing and stepped dicing processing.

[0044] The wafer 102 refers to a silicon wafer used to make a silicon semiconductor circuit, and the original material of the wafer 102 is silicon. High-purity polycrystalline silicon is dissolved and then doped with a silicon crystal seed, and then it is slowly pulled out to form cylindrical monocrystalline silicon. A silicon ingot is ground, polished, and sliced to form a silicon wafer, i.e. a wafer.

[0045] Methods for dicing a wafer mainly include diamond grinding wheel dicing, laser dicing. In laser dicing, high temperature generated by focusing of a high-energy laser beam is used to instantly gasify the silicon material within a radiated local range, to complete the dicing of the silicon wafer. However, the high temperature will induce a thermal stress around a dicing-slit, leading to edge chipping of the silicon wafer, and laser dicing is only suitable for dicing thin wafers. Ultra-thin diamond grinding wheel dicing, because of the small dicing force in dicing and the low dicing cost, is currently the most widely used dicing process. In

the present disclosure, dicing the wafer with the grinding wheel dicing is mainly used.

[0046] FIG. 2 is a schematic diagram of a double-dicing mode. The double-dicing mode is a common dicing mode in a double-shaft dicing machine. Specifically, a scribe line is diced twice sequentially by two dicing blades, in order to dice through the wafer. In FIG. 2, 203 represents a scribe line, 201 represents the first dicing mark formed by dicing the scribe line, and 202 represents the second dicing mark formed by dicing the scribe line.

[0047] A to-be-diced wafer has the scribe line 203, which is configured to mark a position to be diced. The scribe line 203 is of a certain width, and a width of the dicing mark formed by the dicing with the dicing blade is smaller than the width of the scribe line 203, as long as the dicing mark is within the range of the scribe line 203 in the actual dicing. Some wafers may further be provided with wider protection marking lines on both sides of the scribe line 203. Thus, even though the actual dicing marks are outside the scribe line 203, the dicing is considered normal as long as the actual dicing marks are within the range of the protection marking lines.

[0048] In the double-dicing mode shown in FIG. 2, path lengths of respective paths each corresponding to a dicing mark (that is, the first dicing mark 201 and the second dicing mark 202) are not necessarily equal to each other, but the sum of the path lengths needs to be equal to the length of the scribe line. In the double-dicing mode, layered dicing may occur, in which the dicing is performed in the depth direction of the wafer in a layered manner based on the thicknesses of respective dicing materials of the wafer. At this time, the sum of the dicing depths each corresponding to one of the two dicing marks (that is, the first dicing mark 201 and the second dicing mark 202) on the wafer needs to be not less than the thickness of the wafer.

[0049] Materials at different positions on the wafer may be different, and properties such as hardness at the different positions may also be different. Therefore, in the double-dicing mode, two dicing blades are used to dice the same scribe line in sequence, in which each dicing blade is used to dice a position, a material at which is matched with the material of the dicing blade, on the to-be-diced wafer, so that the dicing process may be carried out smoothly. If a dicing blade is used to dice a position (material) that is not suitable for the dicing blade to dice, it is likely to cause damage to the dicing blade, and at the same time, the dicing quality of the wafer is affected.

[0050] In the double-dicing mode, dicing blades with different specifications may be selected to complete the two dicing processes for the same scribe line. For example, in a case that materials of a surface layer and a deep layer of the wafer are different, a dicing blade suitable for dicing a corresponding material is selected to dice the same scribe line sequentially. However, in the process of wafer dicing, the scribe line is often sampled for detecting, in order to detect whether there is an offset in the diced scribe line. If there is an offset, it is necessary to correct the scribe line, to prevent an error in the subsequent dicing.

[0051] In the double-dicing mode of conventional technology, when the sampling occurs after the first dicing of scribe line and before the second dicing of the scribe line, if an offset of the scribe line is detected, the scribe line is calibrated immediately based on the detection result. The second dicing is performed based on the calibrated position. Since the specification of the dicing blade for performing the second dicing may differ from the specification of the dicing blade for performing the first dicing, and the materials suitable for the first dicing and the second dicing are also different, when the dicing is performed again after the scribe line calibration, the dicing blade for the second dicing will dice the wafer at a position which has not been subjected to the first dicing. At this time, the dicing blade for the second dicing will dice the surface material that is not suitable for this dicing blade to dice, which not only affects the quality of the wafer dicing, but also may cause the dicing blade to be damaged or even chipped, reducing the dicing efficiency.

[0052] Based on this, a method for dicing a wafer, a dicing machine, and a storage medium are provided according to embodiments of the present disclosure. It is possible to avoid calibrating a scribe line during two dicing processes on the scribe line, thereby improving the dicing efficiency. The method specifically includes:

[0053] after the first dicing is performed on the current scribe line by a first dicing blade and a first dicing mark is formed and before the second dicing is performed on the current scribe line by a second dicing blade, if a dicing-mark detection is performed and an offset between the first dicing mark and a preset dicing position is obtained, controlling the second dicing blade to dice the current scribe line with the offset being ignored during the second dicing by the second dicing blade; and after the dicing is performed on the current scribe line by the second dicing blade, calibrating a dicing position for a next scribe line based on the offset.

[0054] FIG. 3 is a flowchart of a method for dicing a wafer. As shown in FIG. 3, the method for dicing a wafer, provided according to the present disclosure, is applied to a dicing machine, where the dicing machine dices the wafer in a double-dicing mode in which the dicing machine sequentially dices a same scribe line by two dicing blades. The method specifically includes S11 to S13.

[0055] In S11, a current scribe line is diced by a first dicing blade, to form a first dicing mark.

[0056] In the double-dicing mode, it is usually necessary to perform dicing on the same scribe line twice by a dicing blade, where the wafer is not diced through in the first dicing, and in the second dicing, the scribe line is diced for the second time on the basis of a dicing mark formed by the first dicing, until the wafer is diced through. This is mostly because of the high hardness of the wafer or because the dicing blade fails to dice through the wafer for one time.

[0057] The first dicing mark is formed after the first dicing blade dices the wafer along a preset direction. The wafer is not diced through with the first dicing mark, and thus a straight strip is formed on the wafer.

[0058] Preferably, the above two dicing operations are performed separately by two dicing blades, which means, the wafer is diced by a double-shaft dicing machine.

[0059] Currently, the dicing efficiency of a mainstream double-shaft dicing machine is twice the dicing efficiency of a single-shaft dicing machine by using a double-shaft dicing blade to dice during operation. The double-shaft dicing machine may implement a process which cannot be implemented by a single-shaft dicing machine, such as a stepped dicing, where a dicing blade first slots the wafer, and then another dicing blade dices through the wafer. In the present disclosure, a double-shaft dicing machine or a dicing machine with a double-dicing mode are mainly used.

[0060] The wafer to be diced has a scribe line, which is configured to mark a position to be diced. The scribe line is of a certain width, and a width of the dicing mark formed by the dicing with the dicing blade is smaller than the width of the scribe line as long as the dicing mark is within the range of the scribe line in the actual dicing. Some wafers may further be provided with wider protection marking lines on both sides of the scribe line. Thus, even

though the actual dicing marks are outside the scribe line, the dicing is considered normal as long as the actual dicing marks are within the range of the protection marking lines.

[0061] In S12, if, before dicing the current scribe line by a second dicing blade, a dicing-mark detection is performed and an offset between the first dicing mark and a preset dicing position for the current scribe line is obtained, the current scribe line is diced by the second dicing blade with the offset being ignored during the dicing process by the second dicing blade.

[0062] The first dicing blade and the dicing blades mentioned in the present discourse may be two dicing blades with different specifications or two dicing blades with the same specifications. In the double-dicing mode, there is a dicing sequence for the first dicing blade and the second dicing blade, in which it requires the first dicing blade to dice the current scribe line first, followed by the second dicing blade to dice the current scribe line.

[0063] The first dicing mark as formed is detected. Here, a camera will move to the first dicing mark to take a photo to detect a specific position of the first dicing mark, and then the position of the first dicing mark is compared with the position of the preset scribe line. If a comparison result indicates that the position of the first dicing mark exceeds a preset range, it is determined that there is an offset, and it is determined that there is no offset if the comparison result indicates that the position of the first dicing mark does not exceed the preset range. The preset range here may refer to the range of the scribe line, or may refer to the range formed by the outer protetion marking lines of the scribe line. The preset range may be specifically set by those skilled in the art based on the actual situation and application scenarios, which is not limited herein.

[0064] The dicing-mark detection is mainly to determine whether there is an offset between a dicing mark formed on the scribe line and a preset dicing position of the scribe line. FIG. 4 is a flowchart of a method for detecting a dicing mark. As shown in FIG. 4, the method specifically includes S121 and S122.

[0065] In S121, a camera is driven to move to and take a photo of the current scribe line. A drive mechanism for driving a relative motion between the camera and a carrier for carrying the wafer is preconfigured so that, when the camera takes a photo of a scribe line, a reference line of the camera is located within the scribe line, and the reference line is configured to: mark a preset dicing-mark position of the scribe line.

[0066] The reference line of the camera is located within the scribe line in S121. The scribe line is of a certain width, and the dicing may be performed as long as the dicing position is within the range of the scribe line. Thus, the reference line of the camera being located within the scribe line can be that the reference line of the camera is located at any position within the range of the scribe line or in the center of the range of the scribe line. The position of the reference line of the camera may be determined manually or automatically by those skilled in the art based on the actual situation and application scenarios, which is not limited herein.

[0067] A dicing-mark detection algorithm is mainly used in the existing dicing-mark detection, including, for example: constructing an average gray-value curve by calculating an average gray value of pixels on each line in an extension direction of the dicing mark, and then determining an upper-edge straight line and a lower-edge straight line of the dicing mark by using a preset gray threshold, which means that it is possible to determine a width and a center of the dicing mark; and then determining a chipping region for the dicing mark by the upper-edge straight line and the lower-edge straight line, so as to obtain an area of the chipping region for the dicing mark. As such, it provides a basis for the dicing machine to determine whether to alarm or carry out the adjustment of the blade body or the correction of the reference line or to continue the dicing in a software control. The algorithm requires gray-value extraction, which is more dependent on a lighting manner and has higher requirements on the lighting manner. It is more complicated to implement.

[0068] The dicing-mark detection is implemented by taking a photo using a camera in embodiments of the present disclosure. In the process, firstly the camera is driven to move to the to-be-detected scribe line, where the reference line of the camera is located within the range of the to-be-detected scribe line, and the reference line is used to mark the preset dicing-mark position of the to-be-detected scribe line. At this time, the reference line of the camera marks a desired dicing position which should be located in an allowed area for dicing marked by the scribe line, or in the true center position of the scribe line.

[0069] The center position of the scribe line may be determined by using the automatic alignment procedure of the dicing machine. Firstly, the position of the scribe line is determined, and then a photo of the scribe line is taken with the camera. After performing feature extraction on the photo and calculation, the center position of the scribe line is obtained. The center position of the scribe line may also be determined by means of a manual

control manner, which is not limited herein.

[0070] The preset dicing position of the scribe line may be determined by using the reference line of the camera, and the distance between the current scribe line and a preset scribe line may be determined based on a moving distance of the camera towards the current scribe line.

[0071] In S122, the offset is determined based on a distance between the reference line of the camera and the first dicing mark.

[0072] The offset may be understood as the distance between the reference line of the camera and an actual dicing mark, or it may be considered as the relative position between them. The offset may be obtained by mathematical calculation or programming algorithms, and the specific method for obtaining the offset may be selected by those skilled in the art based on application scenarios and the specific situation, which is not set herein.

[0073] In S13, after the dicing the current scribe line by the second dicing blade, a dicing position for a next scribe line is calibrated based on the offset.

[0074] In the present disclosure, in a case that the dicing-mark detection is performed after the dicing of the current scribe line by the first dicing blade and before the dicing of the current scribe line by the second dicing blade, even if the offset between the dicing mark and the preset dicing position is obtained, the offset is ignored; until the dicing of the current scribe line by the second dicing blade is completed, the offset is used to calibrate the next scribe line. This avoids calibrating before performing the second dicing on the current scribe line. If the second dicing is performed along the calibrated scribe line, the quality of the wafer dicing is affected and the dicing blade may be damaged or even chipped, thereby reducing the dicing efficiency. The reason why calibrating before the second dicing of the current scribe line affects the dicing efficiency is as follows. The specification of the dicing blade for performing the second dicing may differ from the specification of the dicing blade for performing the first dicing, and the materials suitable for the respective dicing blades are also different. Thus, when the dicing is performed again after the scribe line calibration, the dicing blade for the second dicing will dice the wafer at a position which has not been subjected to the first dicing. At this time, the dicing blade for the second dicing will dice the surface material that is not suitable for it to dice, leading to bad phenomena such as chipping. FIG. 5 is a flowchart of a method for determining an offset. The method for determining an offset

specifically includes S21 and S22.

[0075] In S21, the camera is controlled to move from a preset dicing-mark position of the current scribe line, such that the reference line of the camera is moved towards the first dicing mark until the first dicing mark coincides with the reference line of the camera.

[0076] There is a straight line in the middle of the field of view of the camera, which is the reference line of the camera. For the position of the reference line of the camera, the camera start moving from the position of the preset dicing mark of the current scribe line towards the position of the actual dicing mark, until the reference line of the camera coincides with the position of the actual dicing mark.

[0077] In S22, a distance by which the camera is moved from the preset dicing-mark position of the current scribe line towards the first dicing mark is acquired, and the distance is determined as the offset.

[0078] To facilitate understanding, the following detailed description is made in conjunction with FIG. 6, which is a schematic diagram of the determined offset. In the figure, a current scribe line 600, a preset dicing-mark position 610, a first dicing mark 620, and an offset 630, which is the distance between the first dicing mark 620 and the preset dicing-mark position 610, are shown. By using the offset and the preset dicing-mark position of the next scribe line, the dicing position for the next scribe line may be calibrated.

[0079] In this embodiment, by controlling the camera to move from the preset dicing-mark position to the first dicing mark, the offset between the first dicing mark of the current scribe line and the preset dicing-mark position of the current scribe line is determined based on the distance by which the reference line of the camera is moved. With this method, the offset may be determined more conveniently and quickly. The preset dicing-mark position of the scribe line is pre-set before dicing, and the specific setting method may be determined by those skilled in the art based on the actual situation and application scenarios, which is not limited herein.

[0080] For the calibration of the next scribe line, the following method is mainly used: after the first dicing blade and the second dicing blade dice the current scribe line, performing, based on a preset distance between the current scribe line and the next scribe line and the offset, a mathematical operation using the offset and the preset distance to determine a

distance between the current scribe line and a preset dicing-mark position of the next scribe line, and calibrating a dicing position for the next scribe line based on the distance.

[0081] The wafer has multiple scribe lines thereon. In the dicing process, the number of scribe lines which have been diced by the first dicing blade and/or the number of scribe lines that have been diced by the second dicing blade is obtained, and the dicing-mark detection is triggered each time dicing of a preset number of scribe lines is completed. The above mentioned preset number may be determined by a person skilled in the art according to the actual technical requirements, and is not limited herein.

[0082] Although the operations are described in a specific order, this should not be understood as requiring these operations to be performed in the specific order shown or in a sequential order. Under certain circumstances, multitasking and processing in parallel may be advantageous.

[0083] It should be understood that, steps described in the embodiments of the method of the present disclosure may be performed in different orders and/or performed in parallel. In addition, the implementation of the method may include additional steps and/or the shown steps may be omitted. The scope of the present disclosure is not limited thereto.

[0084] Flow charts and block diagrams in the drawings illustrate architecture, functions and operations that may be implemented by the method according to the embodiments of the present disclosure. In this regard, each block in the flow charts or the block diagrams may represent a module, a program segment, or a part of codes, and the module, the program segment, or the part of codes includes one or more executable instructions for implementing the specified logical function. It should be noted that, in some alternative implementations, the functions marked in blocks may be performed in an order different from the order shown in the drawings. For example, two blocks shown in succession may actually be executed in parallel, or sometimes may be executed in a reverse order, which depends on functions involved. It should be noted that each block in the block diagrams and/or the flow charts and a combination of blocks in the block diagrams and/or the flow charts may be implemented by using a dedicated hardware-based system for performing a specified function or operation, or may be implemented by using a combination of dedicated hardware and a computer instruction.

[0085] FIG. 7 is a structural schematic diagram of a dicing machine. As shown in FIG. 7,

the dicing machine includes: a detecting module 100, a dicing module 200, and a processor 300.

[0086] The dicing module 200 includes two dicing blades, i.e., a first dicing blade 210 and a second dicing blade 220.

[0087] The detecting module 100 is configured to perform a dicing-mark detection on a current scribe line and obtain an offset between a first dicing mark and a preset dicing position of the current scribe line.

[0088] The dicing module 200 is configured to: when the dicing machine dices a wafer in a double-dicing mode, sequentially dice a same scribe line by the two dicing blades.

[0089] The processor 300 is configured to: if, before dicing the current scribe line by a second dicing blade, the dicing-mark detection is performed and the offset between the first dicing mark and a preset dicing position of the current scribe line is obtained by the detecting module, control the second dicing blade to dice the current scribe line with the offset being ignored during the dicing by the second dicing blade; and, after the dicing of the current scribe line by the second dicing blade, calibrate the dicing position for a next scribe line based on the offset.

[0090] The detecting module 100 includes a camera 110, and the detecting module 100 is specifically configured to:

[0091] drive the camera 110 to move to and take a photo of the current scribe line, where a drive mechanism for driving a relative motion between the camera 110 and a carrier for carrying the wafer is preconfigured so that, when the camera 110 takes a photo of a scribe line, a reference line of the camera 110 is located in a range of the scribe line, and the reference line is configured to mark a preset dicing-mark position of the scribe line;

[0092] determine the offset based on the distance between the reference line of the camera 110 and the first dicing mark; and

[0093] after the first dicing blade and the second dicing blade dice the current scribe line perform, based on a preset distance between the current scribe line and the next scribe line and the offset, a mathematical operation using the offset and the preset distance to determine a distance between the current scribe line and a preset dicing-mark position of the next scribe line, and calibrate the dicing position for the next scribe line based on the distance.

[0094] In an embodiment, the first dicing blade and the second dicing blade may be two dicing blades with different specifications or two dicing blades with the same specifications.

[0095] In an embodiment, the camera 110 is controlled to move from the preset dicing-mark position of the current scribe line, so that the reference line of the camera 110 is moved towards the first dicing mark until the first dicing mark coincides with the reference line of the camera 110.

[0096] A distance by which the camera is moved from the preset dicing-mark position of the current scribe line towards the first dicing mark is acquired, and the distance is determined as the offset.

[0097] By means of a dicing machine provided above, performing a second dicing on the same scribe line may be prevented from being affected by the offset detected in the dicing-mark detection, and whenever the dicing-mark detection is triggered, it may be ensured that the positions of two successive dicing processes on the same scribe line are overlapped with each other, so as to avoid the adverse effect on the quality of the dicing and on the dicing blades.

[0098] A corresponding device and a computer readable storage medium is further provided in the embodiments of the present disclosure, for implementing the solution provided in the embodiments of the present disclosure.

[0099] The device includes a memory and a processor. The memory is configured to store instructions or codes. The processor is configured to execute the instructions or codes, so that the device performs a method for dicing a wafer according to any embodiment of the present disclosure.

[0100] In practices, the computer-readable storage medium may adopt any combination of one or more computer-readable media. The computer readable medium may be a computer readable signal medium or a computer readable storage medium. The computer readable storage medium may be, but is not limited to, a system, an apparatus, or a device in an electronic, magnetic, optical, electromagnetic, infrared, or semi-conductive form, or any combination thereof. More specific examples (non-exhaustive list) of the computer readable storage medium include: electrical connection with one or more conductors, a portable computer disk, a hard disk, a random access memory (RAM), read only memory (ROM), an

erasable programmable read-only memory (EPROM or flash memory), an optical fiber, a portable compact disk read-only memory (CD-ROM), an optical storage device, a magnetic storage device, or any suitable combination of the above. In this embodiment, the computer readable storage medium may be any tangible medium containing or storing a program, and the program may be used by or in combination with an instruction execution system, apparatus, or device.

[0101] The computer readable signal medium may be a data signal transmitted in a baseband or transmitted as a part of a carrier wave and carrying computer readable program codes. The propagated data signal may be in various forms, including but not limited to an electromagnetic signal, an optical signal or any proper combination thereof. Alternatively, the computer-readable signal medium may be any computer-readable medium other than the computer-readable storage medium. The computer-readable medium may send, propagate or transmit a program to be used by or in combination with an instruction execution system, apparatus or device.

[0102] The program codes included in the computer-readable medium may be transmitted by using any suitable medium, including but not limited to, a wireless medium, a wire, an optical cable, radio frequency (RF) or the like, or any suitable combination thereof.

[0103] Computer program code for performing operations of the present disclosure may be written in one or more programming languages, or a combination of the foregoing. The programming language includes, but is not limited to: object oriented programming languages such as Java, Smalltalk, and C++, and conventional procedural programming languages such as "C" language, or similar programming languages. The program codes may be entirely executed on a user computer, partially on the user computer, as a standalone software package, partially on the user computer and partially on a remote computer, or entirely on the remote computer or a server. In case of a remote computer, the remote computer may be connected to the user computer through any kind of network, including a local area network (LAN) or a wide area network (WAN). Alternatively, the remote computer may be connected to an external computer (for example, over the Internet provided by an Internet service provider).

[0104] It should be noted that, the relationship terms "first", "second" and the like are only used herein to distinguish one entity or operation from another, rather than to necessitate or imply that an actual relationship or order exists between the entities or operations.

Furthermore, the term “comprise”, “include” or any other variation thereof is intended to cover a non-exclusive inclusion, so that a process, a method, an article, or a device including a set of elements includes not only those elements, but also other elements not expressly listed or elements inherent in such a process, method, article, or device. Unless expressively limited, the statement "including a..." does not exclude the case that other similar elements may exist in the process, method, article or device including the series of elements.

[0105] The above description is only some embodiments of the present disclosure, and the protection scope of the present disclosure is not limited thereto. Any changes or replacements that may be easily conceived by those skilled in the art within the technical scope disclosed in the present disclosure should fall within the protection scope of the present disclosure. Therefore, the protection scope of the present disclosure should be subject to the protection scope of the claims.

CLAIMS

1. A method for dicing a wafer, applied to a dicing machine, wherein the dicing machine dices the wafer in a double-dicing mode in which the dicing machine sequentially dices a same scribe line by two dicing blades, and the method comprises:

dicing the current scribe line by a first dicing blade, to form a first dicing mark;

if, before dicing the current scribe line by a second dicing blade, a dicing-mark detection is performed and an offset between the first dicing mark and a preset dicing position for the current scribe line is obtained, dicing the current scribe line by the second dicing blade with the offset being ignored during the dicing by the second dicing blade; and

after the dicing of the current scribe line by the second dicing blade, calibrating a dicing position for a next scribe line based on the offset.

2. The method according to claim 1, wherein the dicing-mark detection performed on the current scribe line comprises the following steps:

driving a camera to move to and take a photo of the current scribe line, wherein a drive mechanism for driving a relative motion between the camera and a carrier for carrying the wafer is preconfigured so that, when the camera takes a photo of a scribe line, a reference line of the camera is located within the scribe line, and the reference line is configured to mark a preset dicing-mark position of the scribe line; and

determining the offset based on a distance between the reference line of the camera and the first dicing mark.

3. The method according to claim 2, wherein the determining the offset based on the distance between the reference line of the camera and the first dicing mark comprises:

controlling the camera to move from a preset dicing-mark position of the current scribe line, such that the reference line of the camera is moved towards the first dicing mark until the first dicing mark coincides with the reference line of the camera; and

acquiring a distance by which the camera is moved from the preset dicing-mark position of the current scribe line towards the first dicing mark, and determining the distance as the offset.

4. The method according to claim 2 or 3, wherein the calibrating the dicing position for the next scribe line based on the offset comprises:

after the first dicing blade and the second dicing blade dice the current scribe line, performing, based on a preset distance between the current scribe line and the next scribe line and the offset, a mathematical operation using the offset and the preset distance to determine a distance between the current scribe line and a preset dicing-mark position of the next scribe line, and calibrating the dicing position for the next scribe line based on the distance.

5. The method according to claim 1, wherein the wafer has a plurality of scribe lines thereon, and the method further comprises:

obtaining the number of scribe lines that have been diced by the first dicing blade and/or the number of scribe lines that have been diced by the second dicing blade, and triggering the dicing-mark detection each time dicing of a preset number of scribe lines is completed.

6. The method according to claim 1, wherein the first dicing blade and the second dicing blade have different specifications.

7. The method according to claim 1, wherein the first dicing blade and second dicing blade have the same specifications.

8. A dicing machine, wherein the dicing machine comprises: a detecting module, a dicing module, and a processor;

wherein the dicing module comprises two dicing blades;

the detecting module is configured to perform a dicing-mark detection on a current scribe line and obtain an offset between a first dicing mark and a preset dicing position of the current scribe line;

the dicing module is configured to: when the dicing machine dices a wafer in a double-dicing mode, sequentially dice a same scribe line by the two dicing blades; and

the processor is configured to: if, before dicing the current scribe line by a second dicing blade, the dicing-mark detection is performed and the offset between the first dicing mark and the preset dicing position of the current scribe line is obtained by the detecting module, control the second dicing blade to dice the current scribe line with the offset being ignored during the dicing by the second dicing blade; and, after the dicing of the current scribe line by

the second dicing blade, calibrate a dicing position for a next scribe line based on the offset.

9. The dicing machine according to claim 8, wherein the detecting module comprises a camera, and the detecting module is configured to:

drive the camera to move to and take a photo of the current scribe line, wherein a drive mechanism for driving a relative motion between the camera and a carrier for carrying the wafer is preconfigured so that, when the camera takes a photo of a scribe line, a reference line of the camera is located in a range of the scribe line, and the reference line is configured to mark a preset dicing-mark position of the scribe line;

determine the offset based on the distance between the reference line of the camera and the first dicing mark; and

after the first dicing blade and the second dicing blade dice the current scribe line, perform, based on a preset distance between the current scribe line and the next scribe line and the offset, a mathematical operation using the offset and the preset distance to determine a distance between the current scribe line and a preset dicing-mark position of the next scribe line, and calibrate the dicing position for the next scribe line based on the distance.

10. A computer readable storage medium, wherein computer readable storage medium stores a computer program, and the computer program, when being executed by a processor, causes the processor to perform a method for dicing a wafer according to any one of claims 1 to 7.