Amendments to the Specification:

Please change the title to: "MATCHING METHO OF PATTERN LAYOUTS FROM INVERSE LITHOGRAPHY REPLACED PHOTOMASK"

Please replace paragraphs [0001]-[0008] with the following amended paragraphs:

[0001] This application is a division of U.S. patent application Ser. No. 12/348,470, filed January 5, 2009, ~~which is incorporated by reference as if fully set forth.~~ now US Patent 7,984,392 issued on July 19, 2011, claiming foreign priority as well to TW-097141254, filed on October 27, 2008 in Taiwan, the disclosures of which are incorporated herein in their entirety by reference.

[0002] The present invention generally relates to a matching method of pattern layouts from inverse lithography. In particular, the matching method comprises the steps of: analyzing a design layout by hierarchy; categorizing the cells with the same pattern into a group; inversing the design layout by inverse lithography; and assimilating the inversed layout cells in the same group into a selected inversed layout cell.

[0003] Nowadays ~~the~~ most of integrated circuits (ICs) are created by designers using computer programs. Designers define the functionalities of the circuit and analyze them by using computer programs to obtain ~~the electronic equivalent of~~ an equivalent circuit diagram of the electrical properties.

[0004] In order to convert the circuit diagram into a physical integrated circuit, a place and route tool is needed to arrange every electronic component and to construct the wiring to interconnect them for a design layout. Besides, the layers of the layout are to be fabricated as a set of photomask used in the photolithographic processing. Before translating the design layout into a photomask layout, the design layout will be processed by an inverse lithography method and then analyzed by another computer programs to ensure ~~there is~~ no occurrence of wrong patterns or to modify the wrong patterns.

[0005] In the photolithography process~~ing~~, the ~~biggest~~ most serious problem is the image error due to the diffraction effect~~, but~~. However, an optical proximity correction method or other prior methods can be used to compensate the distortions. For instance, the optical proximity correction method can correct the wrong patterns by scattering bars to overcome the problem caused by the diffraction effect.

[0006] A hierarchical method plays an important role for the inverse lithography method~~. This is because~~ based on the reason that the hierarchical method can analyze the design layout to make a hierarchical structure having a plurality of design layout cells with different patterns. In addition, the hierarchical structure can also be used in the optical proximity correction method.

[0007] Please refer to Fig._1, which shows a flow chart of a prior inverse lithography. ~~It~~ The flow chart illustrates ~~that~~ the steps of inversing a design layout

by an inverse lithography method to obtain an inversed design layout; smoothening the inversed design layout to obtain a photomask layout; and then verifying the photomask layout. Fig. 2(A) shows a design layout and Fig. 2(B) shows a photomask layout produced by a prior flow.

[0008] In the above prior flow, there is usually an existing problem that the unexpectedly different photomask patterns as shown in Fig. 2(B) are produced even in the same design layout condition as shown in Fig. 2(A). ~~It~~ Much time may ~~take much time~~ be spent for verifying the photomask layout once ~~we have~~ doubts about errors are resulting from the photomask layout. In addition, using the wrong photomask may cause the yield to be decreased. In the technology industry nowadays, the less wasted time the more competitiveness and the higher yield the higher productivity.

Please replace paragraph [0010] with the following amended paragraph:

[0010] The object of the present invention is to provide a matching method for layout patterns, which makes all patterns in a group identical through categorizing patterns into groups, inspecting the processed patterns and replacing variant processed patterns by a selected one. The purpose of the method is to settle the existing problem that unexpectedly different photomask patterns are produced from the same design layout pattern in the same condition. Then, the time will be saved ~~for not~~ by eliminating the process of verifying the photomask layout several times,

and the yield will increase.

Please replace paragraph [0028] with the following amended paragraph:

[0028] According to one aspect of the present invention, replaced photomask is provided. A replaced photomask comprising: a substrate; and a plurality of etched patterns formed on the substrate according to a photomask layout which has a plurality of photomask layout patterns categorized into a plurality of first groups, each of ~~which~~ the first groups includes a plurality of identical initial layout patterns, and each of the first groups is reproduced from an initial layout having a plurality of initial layout patterns categorized into a plurality of second groups to which the plurality of first groups respectively correspond, wherein the plurality of photomask layout patterns respectively correspond to the plurality of initial layout patterns and at least one of the plurality of the photomask layout patterns is replaced by a standardized photomask layout pattern.

Please replace paragraph [0031] with the following amended paragraph:

[0031] Preferably, the replaced photomask is provided, wherein each of the plurality of first groups ~~each of which~~ consists of a plurality of identical initial layout patterns.

Please replace paragraphs [0035]-[0045] with the following amended paragraphs:

[0035] Fig._1 shows a flow chart of a prior inverse lithography;

[0036] Fig._2(A) shows a prior design layout;

[0037] Fig._2(B) shows a photomask layout produced by a prior flow;

[0038] Fig._3 shows a flow chart of the first preferable embodiment;

[0039] Fig._4 shows a layout;

[0040] Fig._5 shows an inversed layout from the initial layout;

[0041] Fig._6 shows a photomask layout ~~form~~ from the inversed layout;

[0042] Fig._7 shows an assimilated photomask layout from the photomask layout;

[0043] Fig._8 shows layout cells having a plurality of patterns;

[0044] Fig._9 shows a flow chart of the second preferable embodiment; and

[0045] Fig._10 shows a replaced photomask.

Please replace paragraphs [0048]-[0053] with the following amended paragraphs:

[0048] Then, analyze the layout by a method, especially a hierarchical method, to obtain a hierarchical structure having the plurality of initial layout cells. The purpose of using the hierarchical method is to categorize ones of the plurality of initial layout cells having (or consisting of) ~~a~~ the same specific patterns into a group. In Fig._4, the initial layout cells 401 and 402 have the same patterns. In order to make the layout and the photomask layout be inspected conveniently and match with each other, ones of the plurality of initial layout cells having (or consisting of) ~~a~~ the same specific patterns are categorized into a group. By the same

way, the initial layout cells 411, 412, 413 and 414 are categorized into a group.

[0049] Afterward, inverse the layout by a method, especially an inverse lithography method, to obtain an inversed layout having a plurality of inversed layout cells respectively corresponding to the plurality of initial layout cells. Please refer to Fig._5, which shows an inversed layout from the initial layout.

[0050] To ~~make fabricating~~ more conveniently fabricate a photomask ~~more convenient~~, complicated patterns in the inversed layout must be simplified to provide a photomask layout, i.e. smoothening the uneven patterns to cause them flat, so that the photomask layout can be easily used for fabricating a photomask. Please refer to Fig._6, which shows a photomask layout from the inversed layout. The photomask layout has a plurality of photomask layout cells respectively corresponding to the plurality of initial layout cells. The photomask layout cells 401' and 402' are respectively corresponding to the initial layout cells 401 and 402, and the photomask layout cells 411' 412' 413' and 414' are respectively corresponding to the initial layout cells 411, 412, 413 and 414.

[0051] In Fig._6, the photomask layout cells 401' and 402' have different patterns, but the initial layout cells they respectively correspond to are in the same group. In order to make the photomask cells in ~~a~~ the same respective group identical, the photomask layout cells in the same respective group must be inspected to find out any variant photomask layout cell, i.e. any different pattern in

the same photomask cell group. Then all the photomask layout cells in the group can be caused <u>to be</u> identical (shape and size) to each other by replacing the variant ones with a selected one according to a result of the inspection. The above step is also called "assimilating." Please refer to Fig._7, which shows an assimilated photomask layout from the photomask layout.

[0052] Finally, the assimilated photomask layout must be verified by an optical rule check to check whether the assimilated phtomask layout can be used for fabricating a photomask or not. There are many companies including Mentor, Synopsys and so on, which have developed computer programs related to an optical rule check. If the result of an optical rule check is not expected, the initial layout must be inversed again and the above steps must keep repeated till the result meets the requirement. This is to say, the photomask layout cells corresponding to the same initial layout cell group should have the same pattern<u>s</u>.

[0053] According to the above embodiment, the combination of at least two patterns can be defined as a layout cell. The layout cells in a group have ~~not only~~ the same combination<u>s, each of the same combinations includes a plurality</u> of patterns~~ but also~~<u>; and</u> the distances among these patterns <u>are</u> identical to those in each <u>of the other</u> layout cells in the group. Please refer to Fig._8, which shows layout cells having a plurality of patterns, wherein the initial layout cells 803, 804 and 805 <u>each</u> having a plurality of patterns are categorized into a group.

Please replace paragraphs [0057]-[0061] with the following amended paragraphs:

[0057] Please refer to Fig._9, which shows a flow chart of the second preferable embodiment to make inversed layout cells in the group identical for shape and size. The method is usually executed by a prior computer program as follows.

[0058] Firstly, provide a layout having a plurality of patterns which may be different (shape or size) or the same (shape and size). Please refer to Fig._4, which shows a layout.

[0059] Then, analyze the layout by a method, specially a hierarchical method, to obtain a hierarchical structure having the plurality of initial layout cells. The purpose of using the hierarchical method is to categorize ones of the plurality of initial layout cells having (or consisting of) ~~a~~ the same specific patterns into a group. In Fig._4, the initial layout cells 401 and 402 have the same patterns. In order to make the layout and the photomask layout be inspected conveniently and match with each other, ones of the plurality of initial layout cells having (or consisting of) ~~a~~ the same specific patterns are categorized into a group. By the same way, the initial layout cells 411, 412 ,413 and 414 are categorized into a group.

[0060] Afterward, inverse the layout by a method, especially an inverse lithography method, to obtain an inversed layout having a plurality of inversed

layout cells 401" and 402" respectively corresponding to the plurality of initial layout cells 401 and 402. Please refer to Fig._5, which shows an inversed layout from the initial layout. The inversed layout cells 401" and 402" have different patterns, but the initial layout cells they respectively correspond to are in the same group. In order to make the inversed layout cells in ~~a~~ the same respective group identical, the inversed layout cells in the same respective group must be inspected to find out any variant inversed layout cell therefrom, i.e. any different pattern in the same inversed layout cell group. Then all the inversed layout cells in the group can be caused to be identical (shape and size) to each other by replacing the variant ones with a selected one according to a result of the inspection. Then, the replaced inversed layout can be taken for a photomask layout.

[0061] According to the above embodiment, the combination of at least two patterns can be defined as a layout cell. The layout cells in a group have ~~not only~~ the same combinations, each of the same combinations includes a plurality of patterns ~~but also~~; and the distances among these patterns are identical to those in each of the other layout cells in the group. Please refer to Fig._8, which shows layout cells having a plurality of patterns, wherein the initial layout cells 803, 804 and 805 each having a plurality of patterns are categorized into a group.

Please replace paragraphs [0064]-[0066] with the following amended paragraphs:

[0064] The present invention makes all patterns in a group identical through categorizing patterns into groups, inspecting the processed patterns and replacing variant processed patterns by a selected one. The purpose of the method is to solve the existing problem that the different photomask patterns are produced from the same design layout pattern in the same condition, ~~and~~ to save the time ~~for not~~ by eliminating the process of verifying the photomask layout several times, and to increase the yield.

[0065] Please refer to Fig._10, which shows a replaced photomask. The replaced photomask comprises a substrate 1015 and a plurality of etched patterns 1001, 1002, 1011, 1012, 1013 and 1014 formed on the substrate 1015. These etched patterns are formed according to a photomask layout which has a plurality of photomask layout patterns categorized into a plurality of first groups, each of ~~which~~ the first groups includes (or consists of) a plurality of identical initial layout patterns, wherein all the identical initial layout patterns have the same shape and the same size. The photomask layout is inversed from an initial layout having a plurality of initial layout patterns categorized into a plurality of second groups to which the plurality of first groups respectively correspond.

[0066] Besides, the plurality of photomask layout patterns respectively correspond to the plurality of initial layout patterns, and through an algorithm at least one of the plurality of the photomask layout patterns is replaced by a

standardized photomask layout pattern determined by simulating the plurality of photomask layout patterns and then by selecting one of the plurality of photomask layout patterns as the standardized photomask layout pattern according to a result of the simulation, wherein the algorithm execute the step of replacing at least one of the plurality of the photomask layout patterns automatically by a standardized photomask layout pattern.

Please replace the Abstract with the following new Abstract: