A process for fabricating a molding stamp mainly includes the steps of: forming a metal seed film on a substrate; forming a photo resist layer on the metal seed film; exposing the photo resist layer by a direct writing method, and developing the photo resist layer thereby forming a pattern of the photo resist layer, the pattern made of a number of microlens structures and a through hole configured for exposing a portion of the metal seed film therefrom; electroforming a body on the substrate to cover the pattern of the photo resist layer, the body having an extending portion being connected with the metal seed film via the through hole of the photo resist layer; removing the photo resist layer from the substrate; and separating the electroformed body from the substrate.
forming a metal seed film on a substrate

forming a photo resist layer on the metal seed film

exposing the photo resist layer by a direct writing method, and developing the photo resist layer thereby forming a pattern of the photo resist layer, the pattern comprised of a number of microlens structures and a through hole configured for exposing a portion of the metal seed film therefrom

electroforming a body on the substrate to cover the pattern of the photo resist layer, the body having an extending portion being connected with the metal seed film via the through hole of the photo resist layer

removing the photo resist layer from the substrate

separating the electroformed body from the substrate

FIG. 1
FIG. 8
PROCESS FOR FABRICATING MOLDING STAMP

BACKGROUND

[0001] 1. Technical Field

[0002] The present invention relates to a process for fabricating a molding stamp, and particularly, relates to a process for fabricating a molding stamp having a pattern for shaping a number of micro lenses.

[0003] 2. Description of Related Art

[0004] A conventional process for making a molding core typically includes the following steps: depositing a photo resist on a substrate; exposing the photo resist under light and developing the photo resist; etching the substrate to form a pattern and removing the photosist; forming a seed layer on the patterned substrate; electroforming a body on the substrate; and separating the electroformed body from the substrate to obtain the molding core.

[0005] However, the seed layer is mostly remained on the electroformed body, i.e. the molding core, after the electroformed body is separated from the substrate. An attachment between the seed layer and the molding core is not strong enough that the seed layer is easily stripped off, which results in an increased surface roughness of the molding core and an increased defect rate of final products.

[0006] Therefore, a new process for fabricating a molding stamp is desired to overcome the above mentioned problems.

SUMMARY

[0007] An exemplary process for fabricating a molding stamp includes the steps of: forming a metal seed film on a substrate; forming a photo resist layer on the metal seed film; exposing the photo resist layer by a direct writing method, and developing the photo resist layer thereby forming a pattern of the photo resist layer, the pattern comprised of a number of micro lens structures and a through hole configured for exposing a portion of the metal seed film therefrom; electroforming a body on the substrate to cover the pattern of the photo resist layer, the body having an extending portion being connected with the metal seed film via the through hole of the photo resist layer; removing the photo resist layer from the substrate; and separating the electroformed body from the substrate.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] Many aspects of the embodiments can be better understood with references to the following drawings. The components in the drawings are not necessarily drawn to scale, the emphasis instead being placed upon clearly illustrating the principles of the present embodiments. Moreover, in the drawings, like reference numerals designate corresponding parts throughout the several views.

[0009] FIG. 1 is a schematic view for describing a process for fabricating a molding stamp, according to an embodiment of the present invention; and

[0010] FIGS. 2 to 10 are sectional views showing successive stages of the process for fabricating a molding stamp shown in FIG. 1.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0011] Embodiments will now be described in detail below with reference to the drawings.

[0012] Referring to FIG. 1, a process for fabricating a molding stamp diagram is shown according to a first embodiment of the present invention. The process for fabricating a molding stamp includes the steps of: forming a metal seed film on a substrate; forming a photo resist layer on the metal seed film; exposing the photo resist layer by a direct writing method, and developing the photo resist layer thereby forming a pattern of the photo resist layer, the pattern comprised of a number of micro lens structures and a through hole configured for exposing a portion of the metal seed film therefrom; electroforming a body on the substrate to cover the pattern of the photo resist layer, the body having an extending portion being connected with the metal seed film via the through hole of the photo resist layer; removing the photo resist layer from the substrate; and separating the electroformed body from the substrate.

[0013] In detail, referring to FIG. 2, a clean substrate 10 to be treated is provided. In the present embodiment, the substrate 10 is made of light transmitting materials, such as glass, quartz. Selectively, the substrate 10 may be made of opaque materials, such as aluminum, iron, gold, or silver.

[0014] Referring to FIG. 3, a metal seed film 20 made of copper, is disposed on the substrate 10 by sputtering. The metal seed film 20 is configured for attachment and crystal growth of an electroformed body for following processes. The metal seed film 20 may be formed on the substrate 10 by evaporation or spraying. The metal seed film 20 may be made of other kinds of metal, such as nickel.

[0015] Referring to FIG. 4, a photo resist layer 30 is placed on the metal seed film 20. In particular, a photo resist substance is first placed on the metal seed film 20 and then laminated by a pressure laminating device to form the photo resist layer 30 on the metal seed film 20. It is indispensable that other coating methods can also be utilized, such as spraying, or spin coating. A thickness of the photo resist layer 30 is predetermined as desired.

[0016] Referring to FIG. 5, the photo resist layer 30 is exposed to light by performing a direct laser writing method to form a number of first exposed regions 301 and two second exposed regions 303 thereon. The first exposed regions 301 do not reach the metal seed layer 20 in depth, and configured for forming a predetermined pattern including a number of micro lens structures. The two second exposed regions 303 are connected with the metal seed layer 20, and configured for forming through holes therein. Accordingly, when exposing the photo resist layer 30 to light, a laser power or an exposure time may be adjusted as desired. Electric beam direct writing can be also used as an alternative embodiment.

[0017] The photo resist layer 30 is then developed in a developer, and then rinsed. In the embodiment the 30 is rinsed with purified water. When rinsed, unexposed region of the photo resist layer 30 dissolves and then rinsed off the substrate 10. The first exposed regions 301 and two second exposed regions 303 remain on the substrate 10.

[0018] Referring to FIG. 6, the first exposed regions 301 are patterned to form a number of micro lens structures 305 thereon. The two second exposed regions 303 are patterned to form two through holes 307 defined therein and exposed parts of the metal seed film 20.

[0019] In addition, in the present embodiment, between the steps of exposing and developing the photo resist layer 30, the substrate 10 may be placed in a clean oven and the photo resist
layer 30 is baked in a temperature ranging from 70 degree Celsius to 100 degrees Celsius for a time period of about 4 minutes to about 8 minutes.

[0020] Referring to FIG. 7, the substrate 10 is attached to a cathode of an electroforming device, thereby electroforming a body 40 thereon. The electroformed body 40 covers the microlens structures 305 of the photo resist layer 30 and includes a number of molding surfaces 401 corresponding to the microlens structures 305. Further, the electroformed body 40 includes two extending portions 402 connected with the metal seed film 20 via the through holes 307. In the present embodiment, the body 40 is made of nickel.

[0021] Referring to FIG. 8, the photo resist layer 30 is removed from the substrate 10.

[0022] Referring to FIG. 9, the electroformed body 40 is separated from the substrate 10 by etching the metal seed layer 20. In an alternative embodiment, the metal seed layer 20 and the electroformed body 40 are both made of nickel, and the electroformed body 40 is separated from the metal seed layer 20 and the substrate 10 by laser cutting. Referring to FIG. 10, the extending portions 402 of the electroformed body 40 are removed from the electroformed body 40 by abrading, thereby, yielding a desired molding stamp 60 having a number of microlens patterns is thereby obtained.

[0023] It should be noted that the number of the second exposed regions 305 could be modified, such as one, three, four or the other as desired. Correspondingly, the number of the extending portions 402 of the electroformed body 40 is also changed. In addition, the distribution of the second exposed regions 305 may be also modified as desired, and not limited by the above embodiment.

[0024] While certain embodiments have been described and exemplified above, various other embodiments from the foregoing disclosure will be apparent to those skilled in the art. The present invention is not limited to the particular embodiments described and exemplified but is capable of considerable variation and modification without departure from the scope of the appended claims.

What is claimed is:
1. A process for fabricating a molding stamp, comprising:
   forming a metal seed film on a substrate;
   forming a photo resist layer on the metal seed film;
   exposing the photo resist layer using a direct writing method,
   developing the photo resist layer thereby forming the photo resist layer into a patterned photo resist layer, the patterned photo resist layer comprising a plurality of microlens structures and a through hole exposing a portion of the metal seed film therefrom;
   electroforming a metallic body on the substrate to cover the patterned photo resist layer, the metallic body having an extending portion extending through the through hole of the photo resist layer and connected with the exposed portion of the metal seed film;
   removing the photo resist layer from the substrate; and
   separating the metallic body from the metal seed layer.
2. The process of claim 1, wherein the direct writing method is a direct laser writing method or an electric beam direct writing method.
3. The process of claim 1, further comprising baking the photo resist layer at a temperature in a range from 70 to 100 Celsius degree for a period of time of about 4 to about 8 minutes.
4. The process of claim 1, wherein the metal seed film is comprised of copper, the metallic body is comprised of nickel.
5. The process of claim 1, wherein the metal seed film is comprised of copper, the metallic body is comprised of nickel.
6. The process of claim 1, wherein both the metal seed film and the metallic body are comprised of nickel.
7. The process of claim 1, wherein the metallic body is separated from the metal seed layer by etching.

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