

Description

The invention relates to a refractive lens having a transparent lens body at least one reflective surface of which comprises a correction layer of a light-cured synthetic resin which gives the lens body the desired optical profile.

Such a replica lens is known from NL-A-8 400 868. In the process of manufacturing a replica lens, a mould or a matrix is used having an accurately defined surface with is the negative of the desired optical profile of the replica lens. In the exact determination of the surface of mould or matrix the shrinkage of the synthetic resin of the replica lens has been taken into account. A small quantity of a liquid light-curable synthetic resin composition is provided on the surface of the mould. The transparent lens body is then pressed with its refractive surface against the mould, or conversely, the synthetic resin spreading between the lens body surface and the mould surface. Instead of the mould, the lens body may alternatively be provided with the liquid synthetic resin composition. The synthetic resin is cured by irradiation and the lens body together with the cured synthetic resin layer bonded thereto is removed from the mould. The free surface of the synthetic resin layer is the negative of that of the mould. The advantage of the replica process is that lenses with a complicated refractive surface, for example an aspherical surface, can be manufactured in a simple manner without this requiring complicated grinding and polishing processes of the lens body. A lens body will suffice which has a simple refractive surface, for example, a spherical (convex or concave) surface. The lens body is manufactured, for example, from an optical glass type or quartz.

It is the object of the invention to provide an improved replica lens.

According to the invention this object is achieved by means of a replica lens of the type mentioned in the opening paragraph which is characterized in that the lens body comprises one or more auxiliary means or optical components which are bonded to the lens body by using a bonding layer of a light-cured synthetic resin, said bonding layer and said correction layer being bonded together.

Both the correction layer and the bonding layer are preferably manufactured from a UV-light-cured, synthetic resin composition. The synthetic resin composition used for the correction layer may be the same as that used for the bonding layer. Suitable compositions are mixtures of acrylic acid esters (acrylates) or methacrylic acid esters (methacrylates). In NL-A-8400842 and the aforesaid NL-A-8400868, compositions are stated which are particularly suitable for use in the replica lens according to the invention. In general, in choosing the synthetic resin composition for the correction layer attention will be paid in particular to the optical quality, such as a high refractive index of the cured synthetic resin layer. A suitable composition is ethoxylated bisphenol-

A dimethacrylate which after curing with UV-light provides a correction layer having a refractive index of approximately 1.56. In choosing the composition of the bonding layer the emphasis will be laid on the bonding properties. The layer must adhere to the glass or quartz of the lens body and, for example, to the metal of a mounting. The composition based on (meth)acrylate will then preferably have extra polar groups. Suitable compositions are epoxyacrylate, urethaneacrylate or mixtures thereof.

The correction layer and the bonding layer are bonded together and thus form one assembly.

It should be noted that it is known per se from IBM Technical Disclosure Bulletin, vol. 24, no. 1A, pages 417-419 (June 1981) to secure optical elements to holders by means of a special epoxy-adhesive. Due to viscosity of the adhesive and a rather high setting time, the positioning of the optical element to the holder is not optimal and the accuracy of the alignment does not meet the requirements for high quality applications. The optical component is not a replica lens as in the present case.

In a preferred form the replica lens of the invention is characterized in that the transparent lens body comprises a correction layer, and connected thereto an upright edge of a light-cured synthetic resin the surface of which is provided at least partly with a reflection layer and thus forms a mirror bonded integrally to the lens body.

According to another preferred form of the replica lens in accordance with the invention the lens body has an annular mounting or an annular magnet which is perpendicular to the optical axis of the lens and is bonded to the lens body by means of a light-cured synthetic resin bonding layer which is connected to the correction layer.

In an interesting embodiment the lens body is a transparent spherical body which has two correction layers of a light-cured synthetic resin which are situated diametrically oppositely to each other and have an aspherical profile as well as an annular mounting which is perpendicular to the optical axis of the lens and is bonded to the lens body by means of a light-cured synthetic resin bonding layer which is connected to the correction layers.

The replica lens according to the invention is manufactured by a process in which a light-curable, liquid, synthetic resin composition is provided between a refractive surface of a transparent lens body and the surface of a mould the profile of which is the negative of the desired optical profile of the replica lens, the lens body and the mould are accurately positioned relative to each other in which between the mould and the lens body a correction layer of a synthetic resin is formed, a bonding layer of a light-curable, liquid, synthetic resin which contact the correction layer is provided between a non-refractive surface of the lens body and a surface of an optical component or an auxiliary means, the correction layer and the bonding layer are cured in which the optical component or the auxiliary means is

bonded to the lens body and the lens is finally removed from the mould.

This method presents the advantage that in accurately positioning the auxiliary means or the optical component, the already present precise arrangement of the mould (or moulds) with respect to the lens body is used. In fact this latter is necessary to provide the correction layer.

In positioning the auxiliary means or the optical component an adjusting surface of the mould which is present for this purpose is preferably used. Such an adjusting surface may be, for example, a surface which is perpendicular to the optical axis and the mechanical axis of the lens and which serves as a reference, for example, for the lower side of an annular mounting.

Further advantages are that no separate procedure is necessary for providing and positioning the auxiliary means (for example the mounting) of the optical component, that the replica lens due to, for example, the mounting can more easily be released from the mould (moulds), and that the possibility of damage is smaller.

The invention will now be described in greater detail with reference to the drawing, in which

Figure 1 is a cross-sectional view of a replica lens according to the invention placed on a quartz mould.

Reference numeral 12 in Figure 1 denotes a mould manufactured from quartz. The upper surface 13 of mould 12 has an annular recess 14 and an aspherical surface 15 present inside the recess. A liquid, UV-light curable composition based on methacrylic acid esters is provided in recess 14 and on the aspherical surface 15. A lens body 16 manufactured from quartz is pressed with its spherical surface 17 against the aspherical surface 15. A correction layer 18 of the liquid composition is formed between the surfaces 15 and 17. Layer 18 communicates with and forms one assembly with the composition 19 present in recess 14. An annular magnet 20 whose inner surface has a layer 21 of a liquid, UV-light curable composition of acrylic acid esters is provided around the cylindrical non-refractive surface 22 of lens body 16. The lower surface of the annular magnet 20 engages the upper surface 13 of mould 12. This upper surface 13 is perpendicular to the optical axis 23 of the aspherical surface 15 and forms a reference surface for the positioning of annular magnet 20. The assembly is exposed to UV-light, the UV curable composition 18, 19, 21 being cured and consequently annular magnet 20 being bonded to lens body 16. The mechanical axis of annular magnet 20 coincides with the optical axis 23. The lens may be removed from the mould. Finally, surface 24 of the resulting edge part 25 is provided with a reflection layer of metal, for example, by using a vapour deposition process. Herewith the resulting replica lens is provided with a mirror bonded integrally to the lens body 16.

Claims

1. A replica lens having a transparent lens body (16) at least one refractive surface (17) of which has a correction layer (18) of a light-cured synthetic resin which gives the lens body the desired optical profile, characterized in that the lens body (16) has one or more auxiliary means (20) or optical components which are bonded to the lens body (16) by using a bonding layer (21) of a light-cured synthetic resin, said bonding layer (21) and said correction layer (18) being bonded together.

2. A replica lens as claimed in Claim 1, characterized in that the transparent lens body (16) comprises a correction layer (18) and connected thereto an upright edge (25) of a light-cured synthetic resin whose surface (24) is provided at least partly with a reflection layer and thus forms a mirror which is bonded integrally to the lens body (16).

3. A replica lens as claimed in Claim 1 or 2, characterized in that the lens body (16) has an annular mounting or an annular magnet (20) which is perpendicular to the optical axis (23) of the lens (16) and is bonded to the lens body (16) by means of a light-cured synthetic resin bonding layer (21) which is connected to the correction layer (18).

4. A replica lens as claimed in Claim 3, characterized in that the lens body is a transparent spherical body which has two correction layers of a light-cured synthetic resin which are situated diametrically oppositely to each other and have an aspherical profile as well as an annular mounting which is perpendicular to the optical axis of the lens and is bonded to the lens body by means of a light-cured synthetic resin bonding layer which is conducted to the correction layers.

Patentansprüche

1. Replikalinse mit einem transparenten Linsenkörper (16), von dem wenigstens eine brechende Oberfläche (17) mit einer dem Linsenkörper das gewünschte optische Profil verleihenden Korrekturschicht (18) aus einem lichthärtenden Kunststoff versehen ist, dadurch gekennzeichnet, dass der Linsenkörper (16) ein oder mehrere Hilfsmittel (20) oder optische Elemente aufweist, die durch Verwendung einer Verbindungsschicht (21) aus einem lichthärtenden Kunststoff mit dem Linsenkörper (16) verbunden sind, wobei diese Verbindungsschicht (21) sowie die Korrekturschicht (18) miteinander verbunden sind.

2. Replikalinse nach Anspruch 1, dadurch gekennzeichnet, dass der transparente Linsenkörper (16) eine Korrekturschicht (18) sowie einen damit verbundenen aufrechtstehenden Rand (25) aus einem lichthärtenden Kunststoff aufweist, dessen Oberfläche (24) wenigstens teilweise mit einer Reflexionsschicht versehen ist und auf diese Weise einen integral mit dem Linsenkörper (16) verbundenen Spiegel bildet.

3. Replikalinse nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass der Linsenkörper (16) eine

bonded to the lens body and the lens is finally removed from the mould.

This method presents the advantage that in accurately positioning the auxiliary means or the optical component, the already present precise arrangement of the mould (or moulds) with respect to the lens body is used. In fact this latter is necessary to provide the correction layer.

In positioning the auxiliary means or the optical component an adjusting surface of the mould which is present for this purpose is preferably used. Such an adjusting surface may be, for example, a surface which is perpendicular to the optical axis and the mechanical axis of the lens and which serves as a reference, for example, for the lower side of an annular mounting.

Further advantages are that no separate procedure is necessary for providing and positioning the auxiliary means (for example the mounting) of the optical component, that the replica lens due to, for example, the mounting can more easily be released from the mould (moulds), and that the possibility of damage is smaller.

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1. A replica lens having a transparent lens body (16) at least one refractive surface (17) of which has a correction layer (18) of a light-cured synthetic resin which gives the lens body the desired optical profile, characterized in that the lens body (16) has one or more auxiliary means (20) or optical components which are bonded to the lens body (16) by using a bonding layer (21) of a light-cured synthetic resin, said bonding layer (21) and said correction layer (18) being bonded together.

2. A replica lens as claimed in Claim 1, characterized in that the transparent lens body (16) comprises a correction layer (18) and connected thereto an upright edge (25) of a light-cured synthetic resin whose surface (24) is provided at least partly with a reflection layer and thus forms a mirror which is bonded integrally to the lens body (16).

3. A replica lens as claimed in Claim 1 or 2, characterized in that the lens body (16) has an annular mounting or an annular magnet (20) which is perpendicular to the optical axis (23) of the lens (16) and is bonded to the lens body (16) by means of a light-cured synthetic resin bonding layer (21) which is connected to the correction layer (18).

4. A replica lens as claimed in Claim 3, characterized in that the lens body is a transparent spherical body which has two correction layers of a light-cured synthetic resin which are situated diametrically oppositely to each other and have an aspherical profile as well as an annular mounting which is perpendicular to the optical axis of the lens and is bonded to the lens body by means of a light-cured synthetic resin bonding layer which is conducted to the correction layers.

Patentansprüche

1. Replikalinse mit einem transparenten Linsenkörper (16), von dem wenigstens eine brechende Oberfläche (17) mit einer dem Linsenkörper das gewünschte optische Profil verleihenden Korrekturschicht (18) aus einem lichthärtenden Kunststoff versehen ist, dadurch gekennzeichnet, dass der Linsenkörper (16) ein oder mehrere Hilfsmittel (20) oder optische Elemente aufweist, die durch Verwendung einer Verbindungsschicht (21) aus einem lichthärtenden Kunststoff mit dem Linsenkörper (16) verbunden sind, wobei diese Verbindungsschicht (21) sowie die Korrekturschicht (18) miteinander verbunden sind.

2. Replikalinse nach Anspruch 1, dadurch gekennzeichnet, dass der transparente Linsenkörper (16) eine Korrekturschicht (18) sowie einen damit verbundenen aufrechtstehenden Rand (25) aus einem lichthärtenden Kunststoff aufweist, dessen Oberfläche (24) wenigstens teilweise mit einer Reflexionsschicht versehen ist und auf diese Weise einen integral mit dem Linsenkörper (16) verbundenen Spiegel bildet.

3. Replikalinse nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass der Linsenkörper (16) eine



ringförmige Fassung oder einen Ringmagneten (20) aufweist, die bzw. der senkrecht zu der optischen Achse (23) der Linse (16) steht und mittels einer aus lichthärtendem Kunststoff bestehenden mit der Korrekturschicht (18) verbundenen Verbindungsschicht (21) mit dem Linsenkörper (16) verbunden ist.

4. Replikalinse nach Anspruch 3, dadurch gekennzeichnet, dass der Linsenkörper ein transparenter kugelförmiger Körper ist, der mit zwei einander diametral gegenüberliegenden und ein asphärisches Profil aufweisenden Korrekturschichten aus einem lichthärtenden Kunststoff, sowie mit einer senkrecht auf der optischen Achse der Linse stehenden und mittels einer aus einem lichthärtenden Kunststoff bestehend, mit den Korrekturschichten verbundenen Verbindungsschicht mit dem Linsenkörper verbundenen ringförmigen Fassung versehen ist.

Revendications

1. Lentille réfractrice présentant un corps de lentille transparent (16) dont au moins une surface réflectrice (17) comporte une couche de correction (18) en une matière synthétique durcie par de la lumière qui confère le profil optique désiré au corps de la lentille, caractérisée en ce que le corps de lentille (16) comporte un ou plusieurs moyens auxiliaires (20) ou composants optiques qui sont adhérents au corps de lentille (16) à l'aide d'une couche d'adhérence (21) en une matière synthétique durcie par de la lumière,

ladite couche d'adhérence (21) et ladite couche de correction (18) étant adhérentes l'une à l'autre.

2. Lentille réplique selon la revendication 1, caractérisée en ce que le corps de lentille (16) transparent comporte une couche de correction (18) sur laquelle est fixé un bord relevé (25) d'une matière synthétique durcie par de la lumière dont la surface (24) est au moins partiellement munie d'une couche réflectrice et constitue ainsi un miroir relié de façon intégrale au corps de lentille (16).

3. Lentille réplique selon la revendication 1 ou 2, caractérisée en ce que le corps de lentille (16) présente un châssis annulaire ou un aimant annulaire (20) qui est perpendiculaire à l'axe optique (23) de la lentille (16) et qui est fixé au corps de lentille (16) à l'aide d'une couche d'adhérence (21) en une matière synthétique durcie par de la lumière qui est fixée à la couche de correction (18).

4. Lentille réplique selon la revendication 3, caractérisée en ce que le corps de lentille est un corps sphérique transparent qui présente deux couches de correction en une matière synthétique durcie par de la lumière qui se situent d'une façon diamétralement opposée l'une par rapport à l'autre et qui sont munies d'un profil asphérique ainsi que d'un châssis annulaire qui est perpendiculaire à l'axe optique de la lentille et qui est fixé au corps de lentille à l'aide d'une couche d'adhérence en matière synthétique durcie par de la lumière qui est adhérente aux couches de correction.

