United States Patent	12386137
Kind Code	B2
Date of Patent	August 12, 2025
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Imaging lens assembly, imaging lens assembly module, camera module and electronic device

Abstract

An imaging lens assembly has an optical axis and includes at least one lens element. The at least one lens element includes an optical effective region and a peripheral portion. The peripheral portion includes an object-side surface, an image-side surface, a peripheral surface, an annular marking structure and at least one arc portion. The object-side surface faces towards an object side. The image-side surface faces towards an image side and corresponds to the object-side surface. The peripheral surface connects the object-side surface and the image-side surface. The annular marking structure is disposed on one of the object-side surface and the image-side surface, and the annular marking structure is an annular tip-ended protruding structure and surrounds the optical axis. The arc portion is disposed on the other one of the object-side surface and the image-side surface, and the arc portion is an annular protruding arc.

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Appl. No.: **17/830626**

Filed: **June 02, 2022**

Prior Publication Data

Document Identifier	Publication Date
US 20230135916 A1	May. 04, 2023

Foreign Application Priority Data

TW	110140160	Oct. 28, 2021

Publication Classification

Int. Cl.: **G02B7/02** (20210101); **B60R11/00** (20060101); **B60R11/04** (20060101); **G02B7/00** (20210101); **G02B13/00** (20060101)

U.S. Cl.:

CPC **G02B7/021** (20130101); **G02B7/003** (20130101); B60R2011/004 (20130101); B60R11/04 (20130101); G02B13/001 (20130101)

Field of Classification Search

USPC: None

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Background/Summary

RELATED APPLICATIONS

(1) This application claims priority to Taiwan Application Serial Number 110140160, filed Oct. 28, 2021, which is herein incorporated by reference.

BACKGROUND

Technical Field

(2) The present disclosure relates to an imaging lens assembly, an imaging lens assembly module and a camera module. More particularly, the present disclosure relates to an imaging lens assembly, an imaging lens assembly module and a camera module with compact size applicable to portable electronic devices.

Description of Related Art

(3) In recent years, camera modules which are developed rapidly and have been filled with the lives of modern people are applied in various fields such as portable electronic devices, head mounted devices, vehicle devices and etc. Accordingly, the camera module and the image sensor are also flourished. However, as technology is more and more advanced, demands for the quality of the camera module of users have become higher and higher. Therefore, developing an imaging lens assembly module which can improve size accuracy and demolding yield rate of the lens element becomes an important and solving problem in industry.

SUMMARY

(4) According to one aspect of the present disclosure, an imaging lens assembly has an optical axis and includes at least one lens element. The at least one lens element includes an optical effective region and a peripheral portion. The optical axis passes through the optical effective region. The peripheral portion surrounds the optical effective region and includes an object-side surface, an image-side surface, a peripheral surface, an annular marking structure and at least one arc portion. The object-side surface faces towards an object side. The image-side surface faces towards an image side and corresponds to the object-side surface. The peripheral surface connects the object-side surface and the image-side surface. The annular marking structure is disposed on one of the object-side surface and the image-side surface, and the annular marking structure is an annular tip-ended protruding structure and surrounds the optical axis. The arc portion is disposed on the other one of the object-side surface and the image-side surface, and the arc portion is an annular protruding arc. When a perpendicular distance between the annular marking structure and the optical axis is dm, a perpendicular distance between the arc portion and the optical axis is da, and a curvature radius of the arc portion is Ra, the following conditions are satisfied: $0.82<da/dm<1.18$; and $0.025\ \text{mm}\leq Ra\leq 0.5\ \text{mm}$.

(5) According to one aspect of the present disclosure, an imaging lens assembly module includes a lens barrel and an imaging lens assembly. The imaging lens assembly is disposed in the inner space of the lens barrel, the imaging lens assembly has an optical axis and includes at least one lens element. The at least one lens element includes an optical effective region and a peripheral portion. The optical axis passes through the optical effective region. The peripheral portion surrounds the optical effective region and includes an object-side surface, an image-side surface, a peripheral surface, an annular marking structure and at least one arc portion. The object-side surface faces towards an object side. The image-side surface faces towards an image side and corresponds to the object-side surface. The peripheral surface connects the object-side surface and the image-side surface, and physically contacts one of the inner surfaces of the lens barrel. The annular marking structure is only disposed on the image-side surface, and the annular marking structure is an annular tip-ended protruding structure and surrounds the optical axis. The arc portion is disposed on the object-side surface, and the arc portion is an annular protruding arc. When a perpendicular

distance between the annular marking structure and the optical axis is dm, a perpendicular distance between the arc portion and the optical axis is da, and a curvature radius of the arc portion is Ra, the following conditions are satisfied: $0.75<da/dm<1.25$; and $0.025\ mm\leq Ra\leq 0.5\ mm$.
(6) According to one aspect of the present disclosure, a camera module includes the aforementioned imaging lens assembly module and an image sensor. The image sensor is disposed on an image surface of the imaging lens assembly module.
(7) According to one aspect of the present disclosure, an electronic device includes the aforementioned camera module.

Description

BRIEF DESCRIPTION OF THE DRAWINGS
(1) The present disclosure can be more fully understood by reading the following detailed description of the embodiment, with reference made to the accompanying drawings as follows:
(2) FIG. **1**A shows a three-dimensional schematic view of an imaging lens assembly module according to the 1st embodiment of the present disclosure.
(3) FIG. **1**B shows an exploded view of the imaging lens assembly module according to the 1st embodiment in FIG. **1**A.
(4) FIG. **1**C shows a partial perspective view of the imaging lens assembly module according to the 1st embodiment in FIG. **1**A.
(5) FIG. **1**D shows a schematic view of the imaging lens assembly module according to the 1st embodiment in FIG. **1**A.
(6) FIG. **1**E shows a schematic view of the first lens element according to the 1st embodiment in FIG. **1**D.
(7) FIG. **1**F shows a schematic view of parameters of the first lens element according to the 1st embodiment in FIG. **1**E.
(8) FIG. **1**G shows another schematic view of the imaging lens assembly module according to the 1st embodiment in FIG. **1**A.
(9) FIG. **1**H shows schematic view parameters of the second lens element according to the 1st embodiment in FIG. **1**G.
(10) FIG. **1**I shows another schematic view of the imaging lens assembly module according to the 1st embodiment in FIG. **1**A.
(11) FIG. **1**J shows schematic view parameters of the third lens element according to the 1st embodiment in FIG. **1**I.
(12) FIG. **2**A shows a schematic view of an imaging lens assembly module according to the 2nd embodiment of the present disclosure.
(13) FIG. **2**B shows a schematic view of parameters of the first lens element according to the 2nd embodiment in FIG. **2**A.
(14) FIG. **2**C shows another schematic view of the imaging lens assembly module according to the 2nd embodiment in FIG. **2**A.
(15) FIG. **2**D shows a schematic view of parameters of the second lens element according to the 2nd embodiment in FIG. **2**C.
(16) FIG. **2**E shows another schematic view of the imaging lens assembly module according to the 2nd embodiment in FIG. **2**A.
(17) FIG. **2**F shows a schematic view of parameters of the third lens element according to the 2nd embodiment in FIG. **2**E.
(18) FIG. **3**A shows a schematic view of an electronic device according to the 3rd embodiment of the present disclosure.
(19) FIG. **3**B shows another schematic view of the electronic device according to the 3rd

embodiment in FIG. **3**A.

(20) FIG. **3**C is a schematic view of an image captured by the ultra-wide angle camera module according to the 3rd embodiment in FIG. **3**A.

(21) FIG. **3**D is a schematic view of an image captured by the high-pixel camera module according to the 3rd embodiment in FIG. **3**A.

(22) FIG. **3**E is a schematic view of an image captured by the telephoto camera module according to the 3rd embodiment in FIG. **3**A.

(23) FIG. **4** shows a schematic view of an electronic device according to the 4th embodiment of the present disclosure.

(24) FIG. **5**A shows a schematic view of the vehicle device according to the 5th embodiment of the present disclosure.

(25) FIG. **5**B shows a top view of the vehicle device according to the 5th embodiment in FIG. **5**A.

(26) FIG. **5**C shows a partial enlarged view of the vehicle device according to the 5th embodiment in FIG. **5**B.

(27) FIG. **5**D shows another schematic view of the vehicle device according to the 5th embodiment in FIG. **5**A.

DETAILED DESCRIPTION

(28) The present disclosure provides an imaging lens assembly which has an optical axis and includes at least one lens element. The lens element includes an optical effective region and a peripheral portion. The optical axis passes through the optical effective region. The peripheral portion surrounds the optical effective region and includes an object-side surface, an image-side surface, a peripheral surface, an annular marking structure and at least one arc portion. The object-side surface faces towards an object side. The image-side surface faces towards an image side and corresponds to the object-side surface. The peripheral surface connects the object-side surface and the image-side surface. The annular marking structure is disposed on one of the object-side surface and the image-side surface, and the annular marking structure is an annular tip-ended protruding structure and surrounds the optical axis. The arc portion is disposed on the other one of the object-side surface and the image-side surface, and the arc portion is an annular protruding arc. When a perpendicular distance between the annular marking structure and the optical axis is dm, a perpendicular distance between the arc portion and the optical axis is da, and a curvature radius of the arc portion is Ra, the following conditions are satisfied: $0.82<da/dm<1.18$; and $0.025\ \text{mm}\leq Ra\leq 0.5\ \text{mm}$.

(29) By disposing the annular marking structure only on one surface of the lens element and disposing the arc portion on the other surface, reflection of unnecessary light in the lens element can be reduced while the possibility of over reflection of unnecessary light can be prevented from disposing the annular marking structure on both of the object-side surface and the image-side surface of the lens element. Hence, by disposing the annular marking structure on the single side of the lens element and the arc portion on the other side thereof, size accuracy and demolding yield rate of the lens element can be improved.

(30) Moreover, the annular marking structure can be for positioning the lens element so as to provide a function of compensating tolerance of production.

(31) Specifically, the annular marking structure can be disposed on the image-side surface, and the arc portion is disposed on the object-side surface. The annular marking structure can be a step difference formed during demolding from a mold, a whole circular ring, or a ring with cutting edges, but the present disclosure is not limited thereto. Furthermore, a cross section of the annular marking structure can have an acute angle, wherein the acute angle is between 80 degrees and 100 degrees. In the embodiments, the acute angle is 90 degrees, but the present disclosure is not limited thereto. Moreover, the annular marking structure is an annular tip-ended protruding structure which has a sharped end. Specifically, a curvature radius of the end of the annular marking structure (Rm) can be less than 0.025 mm.

(32) The lens element can be formed by injection molding and further include at least one gate trace, wherein the gate trace is disposed on the peripheral surface. Hence, the precision lens element with high accuracy and compactness can be provided.
(33) When a distance from the annular marking structure to the gate trace along a direction perpendicular to the optical axis is t, the following condition can be satisfied: $t \leq 0.4$ mm. Hence, the efficiency of manufacturing during mass production process can be improved.
(34) When the curvature radius of the arc portion is Ra, the following condition can be satisfied: 0.035 mm$\leq$Ra$\leq$0.45 mm. Hence, the possibility of adhesion between the lens element and the mold can be decreased, and it is favorable for quality management during demolding process.
(35) When the perpendicular distance between the annular marking structure and the optical axis is dm, and a maximum radius of the peripheral surface is ds, the following condition can be satisfied: $0.7<dm/ds<1.0$. Moreover, the following condition can be satisfied: $0.8<dm/ds<1.0$. Hence, the coaxiality of two sides of the optical effective region can be improved.
(36) The optical effective region can include an object-side optical surface and an image-side optical surface. The object-side optical surface faces towards the object side, the image-side optical surface faces towards the image side, and at least one of the object-side optical surface and the image-side optical surface is an optical aspheric surface. Hence, the lens element with high image resolution can be provided.
(37) When a protruding height of the annular marking structure is h, the following condition can be satisfied: 0.0025 mm$\leq$h$\leq$0.1 mm. Hence, it is favorable for recognition by an instrument, and feasibility of demolding from the mold can be provided.
(38) The present disclosure provides an imaging lens assembly module which includes a lens barrel and an imaging lens assembly. The lens barrel has a plurality of inner surfaces and forms an inner space. The imaging lens assembly is disposed in the inner space of the lens barrel. The imaging lens assembly has an optical axis and includes at least one lens element. The lens element includes an optical effective region and a peripheral portion. The optical axis passes through the optical effective region. The peripheral portion surrounds the optical effective region and includes an object-side surface, an image-side surface, a peripheral surface, an annular marking structure and at least one arc portion. The object-side surface faces towards an object side. The image-side surface faces towards an image side and corresponds to the object-side surface. The peripheral surface connects the object-side surface and the image-side surface and contacts one of the inner surfaces of the lens barrel physically. The annular marking structure is only disposed on the image-side surface, and the annular marking structure is an annular tip-ended protruding structure and surrounds the optical axis. The arc portion is disposed on the object-side surface, and the arc portion is an annular protruding arc. When a perpendicular distance between the annular marking structure and the optical axis is dm, a perpendicular distance between the arc portion and the optical axis is da, and a curvature radius of the arc portion is Ra, the following conditions are satisfied: $0.75<da/dm<1.25$; and 0.025 mm$\leq$Ra$\leq$0.5 mm.
(39) Hence, by disposing the annular marking structure on the image-side surface to improve the size accuracy of the lens element and disposing the arc portion on the object-side surface, demolding yield rate of the lens element can be improved.
(40) Moreover, the annular marking structure can be for positioning the lens element so as to provide a function of compensating tolerance of production.
(41) The object-side surface of the lens element can include an axial aligning structure for abutting against and aligning at center of an adjacent lens element. Hence, the yield rate of assembling can be improved so as to provide better image quality. Specifically, the axial aligning structure can include a tilt surface and a flat surface, and the tilt surface and the flat surface are for reducing tilting and shifting between the lens elements so as to align at center.
(42) The image-side surface of the lens element can include an axial aligning structure for abutting against and aligning at center of an adjacent lens element. Hence, the yield rate of assembling can

be improved so as to provide better image quality.
(43) When a length of a region which the peripheral surface contacts the one of the inner surfaces along a direction parallel to the optical axis is L, the following condition can be satisfied: $L<0.1$ mm. Hence, the possibility of generation of stray light can be decreased.
(44) When the perpendicular distance between the annular marking structure and the optical axis is dm, and a maximum radius of the image-side optical surface is di, the following condition can be satisfied: $0.3<di/dm<0.8$. Hence, the replacement rate of the mold can be reduced so as to reduce manufacturing cost.
(45) Each of the abovementioned features of the imaging lens assembly module can be utilized in various combinations for achieving the corresponding effects.
(46) The present disclosure provides a camera module including the aforementioned imaging lens assembly module and an image sensor. The image sensor is disposed on an image surface of the imaging lens assembly module.
(47) The present disclosure provides an electronic device including the aforementioned camera module.
(48) According to the above description of the present disclosure, the following specific embodiments are provided for further explanation.
1st Embodiment
(49) FIG. **1**A shows a three-dimensional schematic view of an imaging lens assembly module **100** according to the 1st embodiment of the present disclosure. FIG. **1**B shows an exploded view of the imaging lens assembly module **100** according to the 1st embodiment in FIG. **1**A. FIG. **1**C shows a partial perspective view of the imaging lens assembly module **100** according to the 1st embodiment in FIG. **1**A. FIG. **1**D shows a schematic view of the imaging lens assembly module **100** according to the 1st embodiment in FIG. **1**A. As shown in FIGS. **1**A-**1**D, the imaging lens assembly module **100** includes a lens barrel **110** and an imaging lens assembly (its reference numeral is omitted). The lens barrel **110** has a plurality of inner surfaces **111** and forming an inner space (its reference numeral is omitted). The imaging lens assembly is disposed in the inner space of the lens barrel **110**, and the imaging lens assembly has an optical axis X and includes at least one lens element. Specifically, the imaging lens assembly includes three lens elements. The three lens elements are a first lens element **120**, a second lens element **130** and a third lens element **140**, respectively, but the present disclosure is not limited thereto.
(50) The imaging lens assembly can further include two light blocking elements **150** and a retainer **160**. Each of the two light blocking elements **150** is disposed between the first lens element **120** and the second lens element **130**, and between the second lens element **130** and the third lens element **140**, respectively. The retainer **160** is disposed on an image-side of the third lens element **140**. Other optical elements can be assembled to the imaging lens assembly according to the optical requirements, but the present disclosure is not limited thereto.
(51) FIG. **1**E shows a schematic view of the first lens element **120** according to the 1st embodiment in FIG. **1**D. FIG. **1**F shows a schematic view of parameters of the first lens element **120** according to the 1st embodiment in FIG. **1**E. As shown in FIGS. **1**C-**1**F, the first lens element **120** includes an optical effective region **121** and a peripheral portion **122**. The optical axis X passes through the optical effective region **121**, and the peripheral portion **122** surrounds the optical effective region **121**. The peripheral portion **122** includes an object-side surface **1221**, an image-side surface **1222**, a peripheral surface **1223**, an annular marking structure **1224** and two arc portions **1225**, **1226**. The object-side surface **1221** faces towards an object side, and the image-side surface **1222** faces towards an image side and corresponds to the object-side surface **1221**. The peripheral surface **1223** connects the object-side surface **1221** and the image-side surface **1222**, and contacts one of the inner surfaces **111** of the lens barrel **110** physically. The annular marking structure **1224** is disposed on one of the object-side surface **1221** and the image-side surface **1222**, and the annular marking structure **1224** is an annular tip-ended protruding structure and surrounds the optical axis

X. The two arc portions **1225**, **1226** are disposed on the other one of the object-side surface **1221** and the image-side surface **1222**, and each of the two arc portions **1225**, **1226** is an annular protruding arc. In the 1st embodiment, the annular marking structure **1224** is disposed on the image-side surface **1222**, and the two arc portions **1225**, **1226** are disposed on the object-side surface **1221**.
(52) Specifically, the optical effective region **121** can include an object-side optical surface **1211** and an image-side optical surface **1212**. The object-side optical surface **1211** faces towards the object side, the image-side optical surface **1212** faces towards the image side, and at least one of the object-side optical surface **1211** and the image-side optical surface **1212** is an optical aspheric surface. In the 1st embodiment, both of the object-side optical surface **1211** and the image-side optical surface **1212** are optical aspheric surfaces.
(53) Moreover, please refer to FIG. **1**B, the first lens element **120** can be formed by injection molding and can further include at least one gate trace **123**. In the 1st embodiment, a number of the gate trace **123** of the first lens element **120** is one, and the gate trace **123** is disposed on the peripheral surface **1223** of the first lens element **120**.
(54) As shown in FIGS. **1**D-**1**F, in the first lens element **120**, when a length of a region which the peripheral surface **1223** contacts the one of the inner surfaces **111** along a direction parallel to the optical axis X is L, a protruding height of the annular marking structure **1224** is h, a distance from the annular marking structure **1224** to the gate trace **123** along a direction perpendicular to the optical axis X is t, a perpendicular distance between the arc portion **1225** and the optical axis X is da, a perpendicular distance between the annular marking structure **1224** and the optical axis X is dm, a maximum radius of the peripheral surface **1223** is ds, and a maximum radius of the image-side optical surface **1212** is di, the conditions related to the parameters can be satisfied as the following Table 1.
(55) TABLE-US-00001 TABLE 1 the first lens element 120 according to the 1st embodiment da (mm) 0.585 dm/ds 0.861 dm (mm) 0.646 di/dm 0.565 da/dm 0.906 L (mm) 0.063 ds (mm) 0.75 h (mm) 0.005 di (mm) 0.365 t (mm) 0.074
(56) In the first lens element **120**, a curvature radius Ra of each of the two arc portions **1225**, **1226** is 0.03 mm and 0.05 mm.
(57) FIG. **1**G shows another schematic view of the imaging lens assembly module **100** according to the 1st embodiment in FIG. **1**A. FIG. **1**H shows schematic view of parameters of the second lens element **130** according to the 1st embodiment in FIG. **1**G. As shown in FIGS. **1**G and **1**H, the second lens element **130** includes an optical effective region **131** and a peripheral portion (its reference numeral is omitted). The optical axis X passes through the optical effective region **131**, and the peripheral portion surrounds the optical effective region **131**. The peripheral portion includes an object-side surface **1321**, an image-side surface **1322**, a peripheral surface **1323**, an annular marking structure **1324** and two arc portions **1325**, **1326**. The object-side surface **1321** faces towards the object side, and the image-side surface **1322** faces towards the image side and corresponds to the object-side surface **1321**. The peripheral surface **1323** connects the object-side surface **1321** and the image-side surface **1322**, and contacts another one of the inner surfaces **111** of the lens barrel **110** physically. The annular marking structure **1324** is disposed on one of the object-side surface **1321** and the image-side surface **1322**, and the annular marking structure **1324** is an annular tip-ended protruding structure and surrounds the optical axis X. The two arc portions **1325**, **1326** are disposed on the other one of the object-side surface **1321** and the image-side surface **1322**, and each of the two arc portions **1325**, **1326** is an annular protruding arc. In the 1st embodiment, the annular marking structure **1324** is disposed on the image-side surface **1322**, and the two arc portions **1325**, **1326** are disposed on the object-side surface **1321**.
(58) Specifically, the optical effective region **131** can include an object-side optical surface **1311** and an image-side optical surface **1312**. The object-side optical surface **1311** faces towards the object side, the image-side optical surface **1312** faces towards the image side, and at least one of

the object-side optical surface **1311** and the image-side optical surface **1312** is an optical aspheric surface. In the 1st embodiment, both of the object-side optical surface **1311** and the image-side optical surface **1312** are optical aspheric surfaces.

(59) Moreover, please refer to FIG. **1**B, the second lens element **130** can be formed by injection molding and can further include at least one gate trace **133**. In the 1st embodiment, a number of the gate trace **133** of the second lens element **130** is one, and the gate trace **133** is disposed on the peripheral surface **1323** of the second lens element **130**.

(60) As shown in FIGS. **1**G and **1**H, in the second lens element **130**, when a length of a region which the peripheral surface **1323** contacts the another one of the inner surfaces **111** along a direction parallel to the optical axis X is L, a protruding height of the annular marking structure **1324** is h, a distance from the annular marking structure **1324** to the gate trace **133** along a direction perpendicular to the optical axis X is t, a perpendicular distance between the arc portion **1325** and the optical axis X is da, a perpendicular distance between the annular marking structure **1324** and the optical axis X is dm, a maximum radius of the peripheral surface **1323** is ds, and a maximum radius of the image-side optical surface **1312** is di, the conditions related to the parameters can be satisfied as the following Table 2.

(61) TABLE-US-00002 TABLE 2 the second lens element 130 according to the 1st embodiment da (mm) 0.634 dm/ds 0.87 dm (mm) 0.696 di/dm 0.603 da/dm 0.911 L (mm) 0.048 ds (mm) 0.8 h (mm) 0.005 di (mm) 0.42 t (mm) 0.074

(62) In the second lens element **130**, a curvature radius Ra of each of the two arc portions **1325**, **1326** is 0.03 mm.

(63) FIG. **1**I shows another schematic view of the imaging lens assembly module **100** according to the 1st embodiment in FIG. **1**A. FIG. **1**J shows schematic view of parameters of the third lens element **140** according to the 1st embodiment in FIG. **1**I. As shown in FIGS. **1**I and **1**J, the third lens element **140** includes an optical effective region **141** and a peripheral portion (its reference numeral is omitted). The optical axis X passes through the optical effective region **141**, and the peripheral portion surrounds the optical effective region **141**. The peripheral portion includes an object-side surface **1421**, an image-side surface **1422**, a peripheral surface **1423**, an annular marking structure **1424** and two arc portions **1425**, **1426**. The object-side surface **1421** faces towards the object side, and the image-side surface **1422** faces towards the image side and corresponds to the object-side surface **1421**. The peripheral surface **1423** connects the object-side surface **1421** and the image-side surface **1422**, and contacts the other one of the inner surfaces **111** of the lens barrel **110** physically. The annular marking structure **1424** is disposed on one of the object-side surface **1421** and the image-side surface **1422**, and the annular marking structure **1424** is an annular tip-ended protruding structure and surrounds the optical axis X. The two arc portions **1425**, **1426** are disposed on the other one of the object-side surface **1421** and the image-side surface **1422**, and each of the two arc portions **1425**, **1426** is an annular protruding arc. In the 1st embodiment, the annular marking structure **1424** is disposed on the image-side surface **1422**, and the two arc portions **1425**, **1426** are disposed on the object-side surface **1421**.

(64) Specifically, the optical effective region **141** can include an object-side optical surface **1411** and an image-side optical surface **1412**. The object-side optical surface **1411** faces towards the object side, the image-side optical surface **1412** faces towards the image side, and at least one of the object-side optical surface **1411** and the image-side optical surface **1412** is an optical aspheric surface. In the 1st embodiment, both of the object-side optical surface **1411** and the image-side optical surface **1412** are optical aspheric surfaces.

(65) Moreover, please refer to FIG. **1**B, the third lens element **140** can be formed by injection molding and can further include at least one gate trace **143**. In the 1st embodiment, a number of the gate trace **143** of the third lens element **140** is one, and the gate trace **143** is disposed on the peripheral surface **1423** of the third lens element **140**.

(66) As shown in FIGS. **11** and **1**J, in the third lens element **140**, when a length of a region which

the peripheral surface **1423** contacts the aforementioned other one of the inner surfaces **111** along a direction parallel to the optical axis X is L, a protruding height of the annular marking structure **1424** is h, a distance from the annular marking structure **1424** to the gate trace **143** along a direction perpendicular to the optical axis X is t, a perpendicular distance between the arc portion **1425** and the optical axis X is da, a perpendicular distance between the annular marking structure **1424** and the optical axis X is dm, a maximum radius of the peripheral surface **1423** is ds, and a maximum radius of the image-side optical surface **1412** is di, the conditions related to the parameters can be satisfied as the following Table 3.
(67) TABLE-US-00003 TABLE 3 the third lens element 140 according to the 1st embodiment da (mm) 0.675 dm/ds 0.831 dm (mm) 0.706 di/dm 0.843 da/dm 0.956 L (mm) 0.077 ds (mm) 0.85 h (mm) 0.005 di (mm) 0.595 t (mm) 0.114
(68) In the third lens element **140**, a curvature radius Ra of each of the two arc portions **1425**, **1426** is 0.05 mm.
2nd Embodiment
(69) FIG. **2**A shows a schematic view of an imaging lens assembly module **200** according to the 2nd embodiment of the present disclosure. As shown in FIG. **2**A, the imaging lens assembly module **200** includes a lens barrel **210** and an imaging lens assembly (its reference numeral is omitted). The lens barrel **210** has a plurality of inner surfaces **211** and forming an inner space (its reference numeral is omitted). The imaging lens assembly is disposed in the inner space of the lens barrel **210**, and the imaging lens assembly has an optical axis X and includes a first lens element **220**, a second lens element **230**, a third lens element **240** and two optical lens elements **250**, **260**.
(70) The imaging lens assembly can further include four light blocking elements **270** and a retainer **280**. Each of the four light blocking elements **270** is disposed between the first lens element **220** and the second lens element **230**, between the second lens element **230** and the third lens element **240**, between the third lens element **240** and the optical lens element **250**, and between the two optical lens elements **250**, **260**, respectively. The retainer **280** is disposed on an image-side of the optical lens element **260**. Other optical elements can be assembled to the imaging lens assembly according to the optical requirements, but the present disclosure is not limited thereto.
(71) FIG. **2**B shows a schematic view of parameters of the first lens element **220** according to the 2nd embodiment in FIG. **2**A. As shown in FIGS. **2**A and **2**B, the first lens element **220** includes an optical effective region **221** and a peripheral portion **222**. The optical axis X passes through the optical effective region **221**, and the peripheral portion **222** surrounds the optical effective region **221**. The peripheral portion **222** includes an object-side surface, an image-side surface, a peripheral surface **2223**, an annular marking structure **2224** and two arc portions **2225**, **2226**. The object-side surface faces towards an object side, and the image-side surface faces towards an image side and corresponds to the object-side surface. The peripheral surface **2223** connects the object-side surface and the image-side surface, and contacts one of the inner surfaces **211** of the lens barrel **210** physically. The annular marking structure **2224** is only disposed on the image-side surface, and the annular marking structure **2224** is an annular tip-ended protruding structure and surrounds the optical axis X. The two arc portions **2225**, **2226** are disposed on the object-side surface and each of the two arc portions **2225**, **2226** is an annular protruding arc.
(72) Specifically, the optical effective region **221** can include an object-side optical surface **2211** and an image-side optical surface **2212**. The object-side optical surface **2211** faces towards the object side, the image-side optical surface **2212** faces towards the image side, and at least one of the object-side optical surface **2211** and the image-side optical surface **2212** is an optical aspheric surface. In the 2nd embodiment, both of the object-side optical surface **2211** and the image-side optical surface **2212** are optical aspheric surfaces.
(73) Moreover, the first lens element **220** can be formed by injection molding and can further include at least one gate trace **223**. A number of the gate trace **223** of the first lens element **220** is one, and the gate trace **223** is disposed on the peripheral surface **2223** of the first lens element **220**.

Hence, the precision lens element with high accuracy and compactness can be provided.
(74) As shown in FIGS. **2**A and **2**B, the image-side surface of the first lens element **220** can include an axial aligning structure (its reference numeral is omitted) for abutting against and aligning at center of the adjacent second lens element **230**. Hence, the yield rate of assembling can be improved so as to provide better image quality. Specifically, the axial aligning structure can include a tilt surface **2227** and a flat surface **2228**, and the tilt surface **2227** and the flat surface **2228** are for reducing tilting and shifting between the first lens element **220** and the second lens element **230** so as to align at center.
(75) In the first lens element **220**, when a length of a region which the peripheral surface **2223** contacts the one of the inner surfaces **211** along a direction parallel to the optical axis X is L, a protruding height of the annular marking structure **2224** is h, a distance from the annular marking structure **2224** to the gate trace **223** along a direction perpendicular to the optical axis X is t, a perpendicular distance between the arc portion **2225** and the optical axis X is da, a perpendicular distance between the annular marking structure **2224** and the optical axis X is dm, a maximum radius of the peripheral surface **2223** is ds, and a maximum radius of the image-side optical surface **2212** is di, the conditions related to the parameters can be satisfied as the following Table 4.
(76) TABLE-US-00004 TABLE 4 the first lens element 220 according to the 2nd embodiment da (mm) 1.322 dm/ds 0.93 dm (mm) 1.442 di/dm 0.534 da/dm 0.917 L (mm) 0.05 ds (mm) 1.55 h (mm) 0.015 di (mm) 0.77 t (mm) 0.079
(77) In the first lens element **220**, a curvature radius Ra of each of the two arc portions **2225**, **2226** is 0.05 mm.
(78) FIG. **2**C shows another schematic view of the imaging lens assembly module **200** according to the 2nd embodiment in FIG. **2**A. FIG. **2**D shows a schematic view of parameters of the second lens element **230** according to the 2nd embodiment in FIG. **2**C. As shown in FIGS. **2**C and **2**D, the second lens element **230** includes an optical effective region **231** and a peripheral portion **232**. The optical axis X passes through the optical effective region **231**, and the peripheral portion **232** surrounds the optical effective region **231**. The peripheral portion **232** includes an object-side surface, an image-side surface, a peripheral surface **2323**, an annular marking structure **2324** and two arc portions **2325**, **2326**. The object-side surface faces towards the object side, and the image-side surface faces towards the image side and corresponds to the object-side surface. The peripheral surface **2323** connects the object-side surface and the image-side surface, and contacts another one of the inner surfaces **211** of the lens barrel **210** physically. The annular marking structure **2324** is only disposed on the image-side surface, and the annular marking structure **2324** is an annular tip-ended protruding structure and surrounds the optical axis X. The two arc portions **2325**, **2326** are disposed on the object-side surface and each of the two arc portions **2325**, **2326** is an annular protruding arc.
(79) Specifically, the optical effective region **231** can include an object-side optical surface **2311** and an image-side optical surface **2312**. The object-side optical surface **2311** faces towards the object side, the image-side optical surface **2312** faces towards the image side, and at least one of the object-side optical surface **2311** and the image-side optical surface **2312** is an optical aspheric surface. In the 2nd embodiment, both of the object-side optical surface **2311** and the image-side optical surface **2312** are optical aspheric surfaces.
(80) Moreover, the second lens element **230** can be formed by injection molding and can further include at least one gate trace **233**. A number of the gate trace **233** of the second lens element **230** is one, and the gate trace **233** is disposed on the peripheral surface **2323** of the second lens element **230**. Hence, the precision lens element with high accuracy and compactness can be provided.
(81) As shown in FIGS. **2**C and **2**D, each of the object-side surface and the image-side surface of the second lens element **230** can include an axial aligning structure (its reference numeral is omitted) for abutting against and aligning at center of the adjacent first lens element **220** and the third lens element **240**, respectively. Hence, the yield rate of assembling can be improved so as to

provide better image quality. Specifically, each of the axial aligning structures of the object-side surface and the image-side surface can include a tilt surface **2327** and a flat surface **2328**, and the tilt surface **2327** and the flat surface **2328** are for reducing tilting and shifting between the first lens element **220** and the second lens element **230**, and between the second lens element **230** and the third lens element **240**, so that the function of alignment at center can be achieved. In detail, the tilt surface **2327** and the flat surface **2328** of the object-side surface of the second lens element **230** correspond to the tilt surface **2227** and the flat surface **2228** of the image-side surface of the first lens element **220**, respectively.

(82) In the second lens element **230**, when a length of a region which the peripheral surface **2323** contacts the another one of the inner surfaces **211** along a direction parallel to the optical axis X is L, a protruding height of the annular marking structure **2324** is h, a distance from the annular marking structure **2324** to the gate trace **233** along a direction perpendicular to the optical axis X is t, a perpendicular distance between the arc portion **2325** and the optical axis X is da, a perpendicular distance between the annular marking structure **2324** and the optical axis X is dm, a maximum radius of the peripheral surface **2323** is ds, and a maximum radius of the image-side optical surface **2312** is di, the conditions related to the parameters can be satisfied as the following Table 5.

(83) TABLE-US-00005 TABLE 5 the second lens element 230 according to the 2nd embodiment da (mm) 1.399 dm/ds 0.932 dm (mm) 1.491 di/dm 5.00 da/dm 0.938 L (mm) 0.01 ds (mm) 1.6 h (mm) 0.03 di (mm) 0.745 t (mm) 0.079

(84) In the second lens element **230**, a curvature radius Ra of each of the two arc portions **2325**, **2326** is 0.025 mm and 0.1 mm.

(85) FIG. **2**E shows another schematic view of the imaging lens assembly module **200** according to the 2nd embodiment in FIG. **2**A. FIG. **2**F shows a schematic view of parameters of the third lens element **240** according to the 2nd embodiment in FIG. **2**E. As shown in FIGS. **2**E and **2**F, the third lens element **240** includes an optical effective region **241** and a peripheral portion **242**. The optical axis X passes through the optical effective region **241**, and the peripheral portion **242** surrounds the optical effective region **241**. The peripheral portion **242** includes an object-side surface, an image-side surface, a peripheral surface **2423**, an annular marking structure **2424** and two arc portions **2425**, **2426**. The object-side surface faces towards the object side, and the image-side surface faces towards the image side and corresponds to the object-side surface. The peripheral surface **2423** connects the object-side surface and the image-side surface, and contacts the other one of the inner surfaces **211** of the lens barrel **210** physically. The annular marking structure **2424** is only disposed on the image-side surface, and the annular marking structure **2424** is an annular tip-ended protruding structure and surrounds the optical axis X. The two arc portions **2425**, **2426** are disposed on the object-side surface and each of the two arc portions **2425**, **2426** is an annular protruding arc.

(86) Specifically, the optical effective region **241** can include an object-side optical surface **2411** and an image-side optical surface **2412**. The object-side optical surface **2411** faces towards the object side, the image-side optical surface **2412** faces towards the image side, and at least one of the object-side optical surface **2411** and the image-side optical surface **2412** is an optical aspheric surface. In the 2nd embodiment, both of the object-side optical surface **2411** and the image-side optical surface **2412** are optical aspheric surfaces.

(87) Moreover, the third lens element **240** can be formed by injection molding and can further include at least one gate trace **243**. A number of the gate trace **243** of the third lens element **240** is one, and the gate trace **243** is disposed on the peripheral surface **2423** of the third lens element **240**. Hence, the precision lens element with high accuracy and compactness can be provided.

(88) As shown in FIGS. **2**E and **2**F, each of the object-side surface and the image-side surface of the third lens element **240** can include an axial aligning structure (its reference numeral is omitted) for abutting against and aligning at center of the adjacent second lens element **230** and the optical lens element **250**, respectively. Hence, the yield rate of assembling can be improved so as to

provide better image quality. Specifically, each of the axial aligning structures of the object-side surface and the image-side surface can include a tilt surface **2427** and a flat surface **2428**, and the tilt surface **2427** and the flat surface **2428** are for reducing tilting and shifting between the second lens element **230** and the third lens element **240**, and between the third lens element **240** and the optical lens element **250**, so that the function of alignment at center can be achieved. In detail, the tilt surface **2427** and the flat surface **2428** of the object-side surface of the third lens element **240** correspond to the tilt surface **2327** and the flat surface **2328** of the image-side surface of the second lens element **230**, respectively.

(89) In the third lens element **240**, when a length of a region which the peripheral surface **2423** contacts the aforementioned other one of the inner surfaces **211** along a direction parallel to the optical axis X is L, a protruding height of the annular marking structure **2424** is h, a distance from the annular marking structure **2424** to the gate trace **243** along a direction perpendicular to the optical axis X is t, a perpendicular distance between the arc portion **2425** and the optical axis X is da, a perpendicular distance between the annular marking structure **2424** and the optical axis X is dm, a maximum radius of the peripheral surface **2423** is ds, and a maximum radius of the image-side optical surface **2412** is di, the conditions related to the parameters can be satisfied as the following Table 6.

(90) TABLE-US-00006 TABLE 6 the third lens element 240 according to the 2nd embodiment da (mm) 1.412 dm/ds 0.934 dm (mm) 1.541 di/dm 0.597 da/dm 0.916 L (mm) 0.04 ds (mm) 1.65 h (mm) 0.06 di (mm) 0.92 t (mm) 0.077

(91) In the third lens element **240**, a curvature radius Ra of each of the two arc portions **2425**, **2426** is 0.05 mm and 0.025 mm.

3rd Embodiment

(92) FIG. **3**A shows a schematic view of an electronic device **10** according to the 3rd embodiment of the present disclosure. FIG. **3**B shows another schematic view of the electronic device **10** according to the 3rd embodiment in FIG. **3**A. In FIGS. **3**A and **3**B, the electronic device **10** according to the 3rd embodiment is a smartphone, and the electronic device **10** includes at least one camera module. In the 3rd embodiment, a number camera module is three, wherein the three camera modules are an ultra-wide angle camera module **12**, a high-pixel camera module **13** and a telephoto camera module **14**, respectively. Furthermore, each of the camera modules can include the imaging lens assembly module according to any one of the 1st embodiment to the 2nd embodiment and an image sensor (not shown), and the image sensor is disposed on an image surface (not shown) of the imaging lens assembly module, but the present disclosure is not limited thereto. Hence, it is favorable for fulfilling a mass production and an appearance requirement of a camera module in the recent market of electronic devices.

(93) Furthermore, the user can activate the capturing mode by a user interface **11** of the electronic device **10**, wherein the user interface **11** according to the 3rd embodiment can be a touch screen for displaying a screen and having a touch function, and the user interface **11** can be for manually adjusting field of view to switch the different camera modules. At this moment, the camera module collects an imaging light on the image sensor and outputs electronic signals associated with images to an image signal processor (ISP) **15**.

(94) Furthermore, the electronic device **10** can further include, but not be limited to, a display, a control unit, a storage unit, a random-access memory (RAM), a read-only memory (ROM), or the combination thereof.

(95) FIG. **3**C is a schematic view of an image captured by the ultra-wide angle camera module **12** according to the 3rd embodiment in FIG. **3**A. In FIG. **3**C, a larger ranged image can be captured via the ultra-wide angle camera module **12**, and the ultra-wide angle camera module **12** has a function for containing more views.

(96) FIG. **3**D is a schematic view of an image captured by the high-pixel camera module **13** according to the 3rd embodiment in FIG. **3**A. In FIG. **3**D, a certain ranged and high-pixel image

can be captured via the high-pixel camera module **13**, and the high-pixel camera module **13** has a function for high resolution and low distortion.

(97) FIG. **3**E is a schematic view of an image captured by the telephoto camera module **14** according to the 3rd embodiment in FIG. **3**A. In FIG. **3**E, a far image can be captured and enlarged to a high magnification via the telephoto camera module **14**, and the telephoto camera module **14** has a function for a high magnification.

(98) In FIGS. **3**C-**3**E, when an image is captured via the camera module having various focal lengths and processed via a technology of an image processing, a zoom function of the electronic device **10** can be achieved.

4th Embodiment

(99) FIG. **4** shows a schematic view of an electronic device **20** according to the 4th embodiment of the present disclosure. In FIG. **4**, the electronic device **20** according to the 4th embodiment is a smartphone, the electronic device **20** includes at least one camera module. In the 4th embodiment, a number camera module is nine, wherein the three camera modules are two ultra-wide angle camera modules **21**, two wide angle camera modules **22**, two high-pixel camera modules **23**, two telephoto camera module **24** and a time-of-flight (TOF) module **25**, respectively. Furthermore, each of the camera modules can include the imaging lens assembly module according to any one of the 1st embodiment and the 2nd embodiment and an image sensor (not shown), the image sensor is disposed on an image surface (not shown) of the imaging lens assembly module, but the present disclosure is not limited thereto. Hence, it is favorable for fulfilling a mass production and an appearance requirement of a camera module in the recent market of electronic devices.

(100) According to the specification of the electronic device **20**, the electronic device **20** can further include at least one auxiliary element (not shown). In the 4th embodiment, the auxiliary element is a flash module **26**. The flash module **26** is for compensating the color temperature. Hence, the camera module of the present disclosure can provide better image capturing experience.

5th Embodiment

(101) FIG. **5**A shows a schematic view of the vehicle device **30** according to the 5th embodiment of the present disclosure. As shown in FIG. **5**A, the vehicle device **30** includes a plurality of camera modules **31**. Each of the camera modules **31** can include the imaging lens assembly module according to any one of the 1st embodiment and the 2nd embodiment and an image sensor (not shown), the image sensor is disposed on an image surface (not shown) of the imaging lens assembly module, but the present disclosure is not limited thereto.

(102) In the 5th embodiment, two of the camera modules **31** are located under two rear view mirrors on the left side and the right side of the vehicle device **30**, respectively. Each of the two camera modules **31** captures image information from a field of view θ. Specifically, the field of view θ can satisfy the following condition: 40 degrees$<\theta<$90 degrees. Hence, the image information in the regions of two lanes on the left side and the right side.

(103) FIG. **5**B shows a top view of the vehicle device **30** according to the 5th embodiment in FIG. **5**A. FIG. **5**C shows a partial enlarged view of the vehicle device **30** according to the 5th embodiment in FIG. **5**B. FIG. **5**D shows another schematic view of the vehicle device **30** according to the 5th embodiment in FIG. **5**A. As shown in FIGS. **5**B and **5**C, two of the camera modules **31** can be disposed in an inner space of the vehicle device **30**. Specifically, the aforementioned two camera modules **31** can be disposed near a rear view mirror in the vehicle device **30** and a rear window, respectively. Moreover, two of the camera modules **31** can be disposed on non-mirror surfaces of two rear view mirrors on left and right side of the vehicle device **30**, respectively. As shown in FIG. **5**D, via the configuration of the camera modules **31**, it is favorable for the user obtaining the external space information out of the driving seat, such as the external space information S**1**, S**2**, S**3**, S**4**, but the present disclosure is not limited thereto. Hence, the angle of view can be provided widely to decrease the blind spot, and it is favorable for improving driving safety.

(104) The foregoing description, for purpose of explanation, has been described with reference to specific embodiments. It is to be noted that Tables show different data of the different embodiments; however, the data of the different embodiments are obtained from experiments. The embodiments were chosen and described in order to best explain the principles of the disclosure and its practical applications, to thereby enable others skilled in the art to best utilize the disclosure and various embodiments with various modifications as are suited to the particular use contemplated. The embodiments depicted above and the appended drawings are exemplary and are not intended to be exhaustive or to limit the scope of the present disclosure to the precise forms disclosed. Many modifications and variations are possible in view of the above teachings.

Claims

1. An imaging lens assembly, having an optical axis and comprising at least one lens element, and the lens element comprising: an optical effective region, the optical axis passing through the optical effective region; and a peripheral portion surrounding the optical effective region, and the peripheral portion comprising: an object-side surface facing towards an object side; an image-side surface facing towards an image side and corresponding to the object-side surface; a peripheral surface connecting the object-side surface and the image-side surface; an annular marking structure disposed on one of the object-side surface and the image-side surface, and the annular marking structure being an annular tip-ended protruding structure and surrounding the optical axis; and at least one arc portion disposed on the other one of the object-side surface and the image-side surface, and the arc portion being an annular protruding arc; wherein a perpendicular distance between the annular marking structure and the optical axis is dm, a perpendicular distance between the arc portion and the optical axis is da, a curvature radius of the arc portion is Ra, and the following conditions are satisfied:
$0.82<da/dm<1.18$; and
$0.025\text{ mm}\leq Ra\leq 0.5\text{ mm}$.
2. The imaging lens assembly of claim 1, wherein the lens element is formed by injection molding and further comprises at least one gate trace, and the gate trace is disposed on the peripheral surface.
3. The imaging lens assembly of claim 2, wherein a distance from the annular marking structure to the gate trace along a direction perpendicular to the optical axis is t, and the following condition is satisfied:
$t\leq 0.4\text{ mm}$.
4. The imaging lens assembly of claim 1, wherein the curvature radius of the arc portion is Ra, and the following condition is satisfied:
$0.035\text{ mm}\leq Ra\leq 0.45\text{ mm}$.
5. The imaging lens assembly of claim 1, wherein the perpendicular distance between the annular marking structure and the optical axis is dm, a maximum radius of the peripheral surface is ds, and the following condition is satisfied:
$0.7<dm/ds<1.0$.
6. The imaging lens assembly of claim 1, wherein the optical effective region comprises: an object-side optical surface facing towards the object side; and an image-side optical surface facing towards the image side, wherein at least one of the object-side optical surface and the image-side optical surface is an optical aspheric surface.
7. The imaging lens assembly of claim 1, wherein a protruding height of the annular marking structure is h, and the following condition is satisfied:
$0.0025\text{ mm}\leq h\leq 0.1\text{ mm}$.
8. An imaging lens assembly module, comprising: a lens barrel having a plurality of inner surfaces and forming an inner space; and an imaging lens assembly disposed in the inner space of the lens

barrel, the imaging lens assembly having an optical axis and comprising at least one lens element, and the lens element comprising: an optical effective region, the optical axis passing through the optical effective region; and a peripheral portion surrounding the optical effective region, and the peripheral portion comprising: an object-side surface facing towards an object side; an image-side surface facing towards an image side and corresponding to the object-side surface; a peripheral surface connecting the object-side surface and the image-side surface, and physically contacting one of the inner surfaces of the lens barrel; an annular marking structure only disposed on the image-side surface, and the annular marking structure being an annular tip-ended protruding structure and surrounding the optical axis; and at least one arc portion disposed on the object-side surface, and the arc portion being an annular protruding arc; wherein a perpendicular distance between the annular marking structure and the optical axis is dm, a perpendicular distance between the arc portion and the optical axis is da, a curvature radius of the arc portion is Ra, and the following conditions are satisfied:

$0.75<da/dm<1.25$; and

$0.025\ \text{mm}\leq Ra\leq 0.5\ \text{mm}$.

9. The imaging lens assembly module of claim 8, wherein the object-side surface of the lens element comprises an axial aligning structure for abutting against and aligning at center of an adjacent lens element.

10. The imaging lens assembly module of claim 8, wherein the image-side surface of the lens element comprises an axial aligning structure for abutting against and aligning at center of an adjacent lens element.

11. The imaging lens assembly module of claim 8, wherein the curvature radius of the arc portion is Ra, and the following condition is satisfied:

$0.035\ \text{mm}\leq Ra\leq 0.45\ \text{mm}$.

12. The imaging lens assembly module of claim 8, wherein the perpendicular distance between the annular marking structure and the optical axis is dm, a maximum radius of the peripheral surface is ds, and the following condition is satisfied:

$0.8<dm/ds<1.0$.

13. The imaging lens assembly module of claim 8, wherein a length of a region which the peripheral surface contacts the one of the inner surfaces along a direction parallel to the optical axis is L, and the following condition is satisfied:

$L<0.1\ \text{mm}$.

14. The imaging lens assembly module of claim 8, wherein the optical effective region comprises: an object-side optical surface facing towards the object side; and an image-side optical surface facing towards the image side, wherein at least one of the object-side optical surface and the image-side optical surface is an optical aspheric surface.

15. The imaging lens assembly module of claim 14, wherein the perpendicular distance between the annular marking structure and the optical axis is dm, a maximum radius of the image-side optical surface is di, and the following condition is satisfied:

$0.3<di/dm<0.8$.

16. The imaging lens assembly module of claim 8, wherein a protruding height of the annular marking structure is h, and the following condition is satisfied:

$0.0025\ \text{mm}\leq h\leq 0.1\ \text{mm}$.

17. A camera module, comprising: the imaging lens assembly module of claim 8; and an image sensor disposed on an image surface of the imaging lens assembly module.

18. An electronic device, comprising: the camera module of claim 17.