Patent Document 5: WO 2013/099640

Patent Document 6: WO 2015/068798

Summary

[0019a]

In a first aspect, the present disclosure refers to a photochromic curable composition comprising:

(A) a polyrotaxane monomer wherein, in a polyrotaxane compound having a composite molecular structure composed of an axial molecule and a plurality of cyclic molecules threaded onto the axial molecule, and side chains having OH groups introduced into the cyclic molecules, 1 mol% or more to less than 100 mol% of the OH groups in the side chains are modified with a compound having a radical-polymerizable group;

(B) a photochromic compound; and

(C) a polymerizable monomer other than the (A) polyrotaxane monomer.

[0019b]

In another aspect, the present disclosure refers to a cured body obtained by curing the photochromic curable composition disclosed herein.

[0019c]

In yet another aspect, the present disclosure refers to a

photochromic laminate, wherein the cured body disclosed herein is laminated on an optical substrate.

[0019d]

In a further aspect, the present disclosure refers to a polyrotaxane monomer,

wherein in a polyrotaxane compound having a composite molecular structure composed of an axial molecule and a plurality of cyclic molecules threaded onto the axial molecule, and side chains having OH groups introduced into the cyclic molecules, OH groups in the side chains are modified, and

wherein

1 mol% or more to less than 100 mol% of OH groups in the side chains are modified with a compound having a radical-polymerizable group,

more than 0 mol% to 99 mol% or less of OH groups in the side chains are modified with a compound not containing a radical-polymerizable group, and

the remaining ratio of OH groups in the side chains is 0 mol% or more to 60 mol% or less.

Technical Problem

[0020]

According to Patent Document 6, excellent photochromic

curable compositions and cured bodies thereof can be obtained by adding a polyrotaxane compound, but the examination by the present inventors revealed the possibility of improvement on the following points. When photochromic curable compositions using the polyrotaxane compounds specifically disclosed in the examples of Patent Document 6 were used, some of the obtained cured bodies had cracks, distortions, and the like, which were assumed to require further improvement. This tendency was especially notable when a photochromic laminate was produced by a coating method.

[0021]

Accordingly, an object of the present invention is to provide a cured body with excellent quality having photochromic properties superior in both color optical density and fading speed and a photochromic curable composition capable of increasing the yield of the cured body, particularly, to provide a photochromic composition for coating which allows

[0228]

In Example 10, an (A) polyrotaxane monomer (this monomer may hereinafter be simply called (A6)) was prepared by performing the same operation as described in Example 1 except that a linear polyethylene glycol having a molecular weight of 20,000 was used as a polymer for forming an axial molecule and ε-caprolactone and 2-acyloyloxyethyl isocyanate were used such that the ratio of modification with acrylate groups (mol%) was 90%, the molecular weight of side chains modified with acrylate groups was approximately 500, and the weight-average molecular weight was 630,000.

[0229]

In Example 11, an (A) polyrotaxane monomer (this monomer may hereinafter be simply called (A7)) was prepared by performing the same operation as described in Example 1 except that a linear polyethylene glycol having a molecular weight of 11,000 was used as a polymer for forming an axial molecule and ε-caprolactone and 2-acyloyloxyethyl isocyanate were used such that the ratio of modification with acrylate groups (mol%) was 85%, the molecular weight of side chains modified with acrylate groups was approximately 300, and the weight-average molecular weight was 180,000.

[0230]

In Example 12, an (A) polyrotaxane monomer (this monomer

may hereinafter be simply called (A8)) was prepared by performing the same operation as described in Example 1 except that a linear polyethylene glycol having a molecular weight of 11,000 was used as a polymer for forming an axial molecule and ε-caprolactone and 2-methacyloyloxyethyl isocyanate were used such that the ratio of modification with methacrylate groups (mol%) was 85%, the molecular weight of side chains modified with methacrylate groups was approximately 300, and the weight-average molecular weight was 180,000.

[0231]In Example 13, an (A) polyrotaxane monomer (this monomer may hereinafter be simply called (A9)) was prepared by performing the same operation as described in Example 1 except that a linear polyethylene glycol having a molecular weight of 11,000 was used as a polymer for forming an axial molecule and ε-caprolactone and 2-acyloyloxyethyl isocyanate were used such that the ratio of modification with acrylate groups (mol%) was 87%, the molecular weight of side chains modified with acrylate groups was approximately 400, and the weight-average molecular weight was 190,000.

[0232]

In Example 14, an (A) polyrotaxane monomer (this monomer may hereinafter be simply called (A10)) was prepared by performing the same operation as described in Example 1 except that a linear polyethylene glycol having a molecular weight of

11,000 was used as a polymer for forming an axial molecule and ε-caprolactone and 2-acyloyloxyethyl isocyanate were used such that the ratio of modification with acrylate groups (mol%) was 86%, the molecular weight of side chains modified with acrylate groups was approximately 600, and the weight-average molecular weight was 220,000.

[0233]

Properties of the (A) polyrotaxane monomers prepared in Examples 9 to 14 are summarized in Table 3.

[0234]