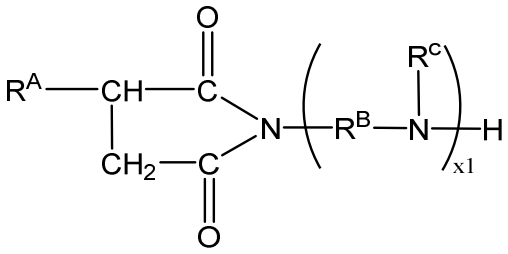
CLAIMS

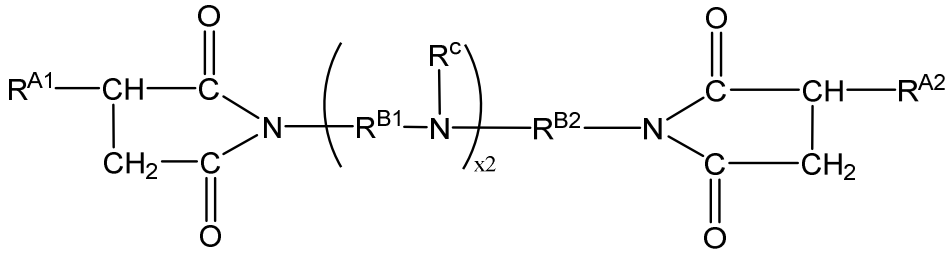
[Claim 1]

A lubricating oil composition comprising: a base oil (A); an imide compound (B); a calcium-based detergent (C); a polymer component (D); and a zinc dithiophosphate (E),

wherein the imide compound (B) comprises at least one non-boron-modified succinic acid imide compound (Bx) selected from a succinic acid monoimide (B1x) represented by the following general formula (b-1) and a succinic acid bisimide (B2x) represented by the following general formula (b-2):



(b-1)



(b-2)

wherein R^A, R^{A1}, and R^{A2} are each independently an alkenyl group having a mass average molecular weight (Mw) of 500 to 4,000,

R^B, R^{B1}, and R^{B2} are each independently an alkylene group having 2 to 5 carbon atoms,

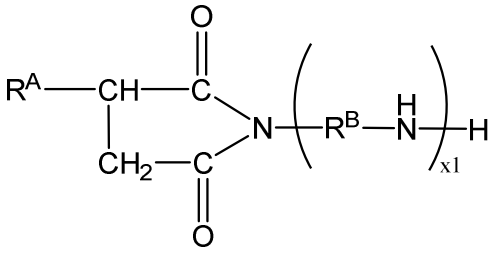
R^C is an alkyl group having 1 to 10 carbon atoms or a group represented by $-(AO)_n-H$ where A represents an alkylene group having 2 to 4 carbon atoms, and n represents an integer of 1 to 10, and

x1 is an integer of 1 to 10, and x2 is an integer of 1 to 10,

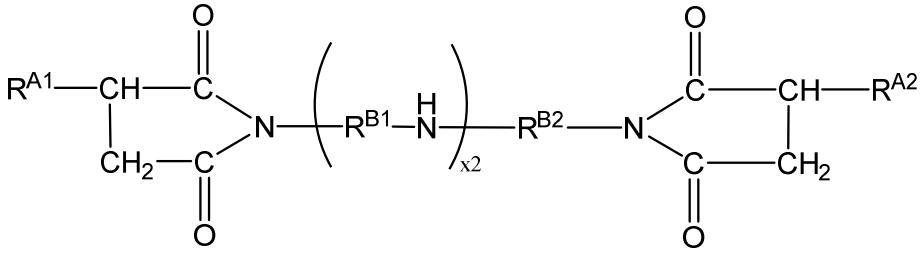
wherein the polymer compound (D) has a mass average molecular weight (Mw) of not less than 10,000 and not more than 50,000, and comprises at least one selected from an olefin polymer (D1) and a polymethacrylate (D2), and

wherein the content of a non-capped succinic acid imide compound (B') selected from a non-capped succinic acid monoimide (B'1) represented by the following general formula (i) and a non-capped succinic acid bisimide (B'2)

represented by the following general formula (ii) is less than 1.0% by mass based on the total amount of the lubricating oil composition:



(i)



(ii)

wherein R^A, R^{A1}, and R^{A2} are each independently an alkenyl group having a mass average molecular weight (Mw) of 500 to 4,000,

R^B, R^{B1}, and R^{B2} are each independently an alkylene group having 2 to 5 carbon atoms, and

x1 is an integer of 1 to 10, and x2 is an integer of 1 to 10.

[Claim 2]

The lubricating oil composition according to claim 1, wherein the imide compound (B) further comprises at least one boron-modified succinic acid imide compound (By) selected from a boron-modified product (B1y) of the succinic acid monoimide (B1x) and a boron-modified product (B2y) of the succinic acid bisimide (B2x), and

wherein the content of boron atoms (By-B) derived from the boron-modified succinic acid imide compound (By) is not more than 0.020% by mass based on the total amount of the lubricating oil composition.

[Claim 3]

The lubricating oil composition according to claim 2, wherein the mass ratio [(By-B)/(B-N)] of the content of boron atoms (By-B) derived from the boron-modified succinic acid imide compound (By) to the content of nitrogen atoms (B-N) derived from the imide compound (B) is not more than 1.0.

[Claim 4]

The lubricating oil composition according to any one of claims 1 to 3, wherein the mass ratio [(E-P)/(B-N)] of the content of phosphorus atoms (E-P) derived from the zinc dithiophosphate (E) to the content of nitrogen atoms (B-N) derived from the imide compound (B) is not less than 0.5 and not more than 5.0.

[Claim 5]

The lubricating oil composition according to any one of claims 1 to 4, wherein the content of nitrogen atoms (N) is not less than 0.010% by mass and not more than 0.10% by mass based on the total amount of the lubricating oil composition.

[Claim 6]

The lubricating oil composition according to any one of claims 1 to 5, wherein the calcium-based detergent (C) is a calcium sulfonate.

[Claim 7]

The lubricating oil composition according to any one of claims 1 to 6, wherein the kinematic viscosity of the composition at 100°C is not less than 4.0 mm^2/s and the kinematic viscosity of the composition at 100°C is less than 20.0 mm^2/s.

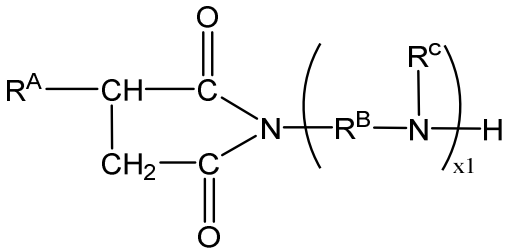
[Claim 8]

The lubricating oil composition according to any one of claims 1 to 7, which is to be used in an internal combustion engine of a motorcycle.

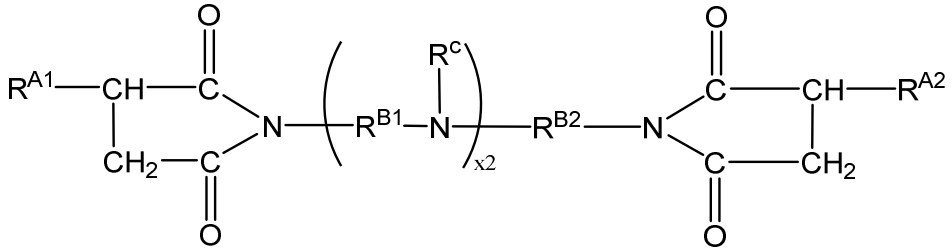
[Claim 9]

A method for producing a lubricating oil composition, comprising: a step of mixing a base oil (A), an imide compound (B), a calcium-based detergent (C), a polymer component (D), and a zinc dithiophosphate (E),

wherein the imide compound (B) comprises at least one non-boron-modified succinic acid imide compound (Bx) selected from a succinic acid monoimide (B1x) represented by the following general formula (b-1) and a succinic acid bisimide (B2x) represented by the following general formula (b-2):



(b-1)



(b-2)

wherein R^A, R^{A1}, and R^{A2} are each independently an alkenyl group having a mass average molecular weight (Mw) of 500 to 4,000,

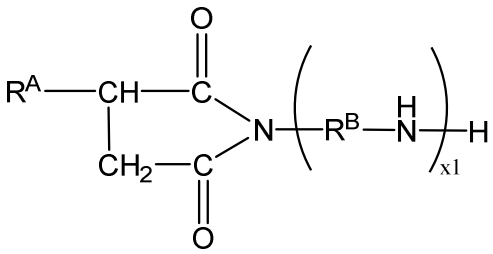
R^B, R^{B1}, and R^{B2} are each independently an alkylene group having 2 to 5 carbon atoms,

R^C is an alkyl group having 1 to 10 carbon atoms or a group represented by $-(AO)_n-H$ where A represents an alkylene group having 2 to 4 carbon atoms, and n represents an integer of 1 to 10, and

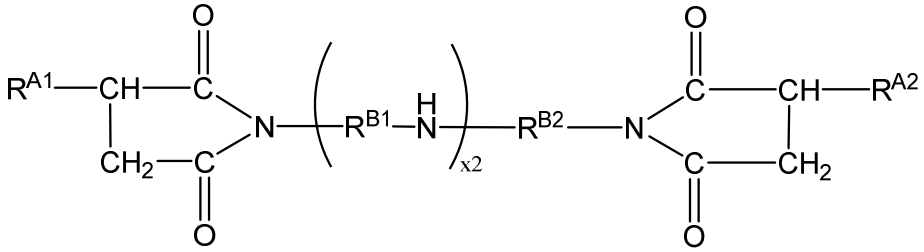
x1 is an integer of 1 to 10, and x2 is an integer of 1 to 10,

wherein the polymer compound (D) has a mass average molecular weight (Mw) of not less than 10,000 and not more than 50,000, and comprises at least one selected from an olefin polymer (D1) and a polymethacrylate (D2), and

wherein the content of a non-capped succinic acid imide compound (B') selected from a non-capped succinic acid monoimide (B'1) represented by the following general formula (i) and a non-capped succinic acid bisimide (B'2) represented by the following general formula (ii) is less than 1.0% by mass based on the total amount of the lubricating oil composition:



(i)



(ii)

wherein R^A, R^{A1}, and R^{A2} are each independently an alkenyl group having a mass average molecular weight (Mw) of 500 to 4,000,

R^B, R^{B1}, and R^{B2} are each independently an alkylene group having 2 to 5 carbon atoms, and

x1 is an integer of 1 to 10, and x2 is an integer of 1 to 10.