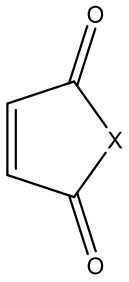
Claims

1. A copolymer comprising

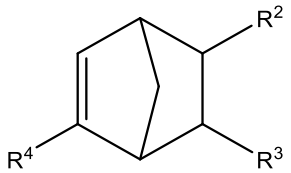
from 47.0 to 99.8 mol.-% of repeating units derived from methyl methacrylate
from 0.1 to 20.0 mol.-% of repeating units derived from the compound represented by formula (I)



(I)

wherein X is represented by an oxygen atom or N-R^1, the substituent R^1 being a hydrogen atom or a hydrocarbon group having from 1 to 12 carbon atoms;

from 0.1 to 18.0 mol.-% of repeating units derived from the compound represented by formula (II)



(II)

wherein the substituents R^2, R^3 and R^4 can be independently represented by a hydrogen atom, a hydrocarbon group having from 1 to 12 carbon atoms, a carboxylic group, -C(O)-C1-12-alkyl, -C(O)-C1-12-cycloalkyl, -C(O)-O-C1-12-alkyl or -C(O)-O-C1-12-cycloalkyl; and wherein R^3 and R^4 can be independently represented by a hydroxy group or build together a cyclic moiety; and

from 0.0 to 15.0 mol.-% of repeating units derived from an optional co-monomer radically copolymerisable with methyl methacrylate and/or compound represented by the formula (I) and/or the formula (II), the optional co-monomer being preferably an alkyl (meth)acrylate, a methacrylic acid, a (meth)acrylonitrile or an aromatic vinyl monomer;

wherein the weight average molecular weight Mw of the copolymer, determined by GPC, is from 40 000 to 300 000 g/mol,

and

wherein the content of repeating units derived from the compound represented by formula (II) p_{II}, in mol.-%, in the copolymer, is described by the following relationship:

$$0.3 * p_I \leq p_{II} \leq 0.9 * p_I$$

wherein p_I is the content of repeating units derived from the compound represented by formula (I), in mol.-%, in the copolymer.

2. Copolymer according to Claim 1, wherein
the compound represented by Formula (I) is maleic acid anhydride and
the compound represented by Formula (II) is 2-norbornene.

3. Copolymer according to any of Claims 1 to 2, wherein the optional co-monomer is methyl acrylate or ethyl acrylate.

4. Copolymer according to any of Claims 1 to 3, wherein Vicat softening temperature according to ISO 306-B50 (2014) is advantageously at least 90 °C, preferably at least 100 °C, more preferably at least 110 °C.

5. A process for the manufacturing of a copolymer according to any of Claims 1 to 4 comprising

(a) a polymerisation step, in which a monomer mixture comprising MMA, a compound of formula (I), a compound of formula (II) and, optionally, an optional co-monomer undergoes radical copolymerisation to form a copolymer solution, copolymer dispersion or copolymer suspension.

6. Process according to Claim 5, wherein the copolymerisation step (a) is carried out in presence of a solvent which is preferably selected from toluene, butyl acetate, ethyl acetate, xylene, dimethylfurane, methyl ethyl ketone or a mixture of any of those.

7. Process according to Claim 5 or 6, wherein the total monomer feed in the polymerisation step (a) has the following composition, based on the total amount of polymerizable components:

from 28.0 to 99.7 mol.-% of methyl methacrylate
from 0.1 to 22.0 mol.-% of the compound represented by formula (I)
from 0.2 to 35.0 mol.-% of the compound represented by formula (II); and
from 0.0 to 15.0 mol.-% of an optional co-monomer radically copolymerisable with methyl methacrylate and/or compound represented by formula (I) and/or (II).

8. Process according to any of Claims 5 to 7, wherein the content of the compound represented by formula (II) m_{II}, in mol.-%, in the total monomer feed in the polymerisation step (a), is described by the following relationship:

$$0.3 * m_I \leq m_{II} \leq 2.0 * m_I$$

wherein m_I is the content of the compound represented by formula (I), in mol.-%, in the monomer mixture.

9. Process according to any of Claims 5 to 8, wherein the polymerization step (a) is carried out in a discontinuously or continuously operated stirred tank reactor, a continuously operated tubular reactor, a discontinuously or continuously operated loop reactor or a combination of any those, and wherein if several reactors are employed, they are operated in parallel or are sequentially connected.

10. Process according to any of Claims 5 to 9, wherein the polymerization step (a) is carried out in at least one continuously operated stirred tank reactor sequentially connected with a tubular reactor, wherein the tubular reactor is located downstream from the stirred tank reactor.

11. Process according to any of Claims 5 to 10, wherein the conversion in the polymerization step (a) is at least 40%, preferably at least 45%.

12. Process according to any of Claims 5 to 11, wherein the polymerisation step (a) is followed by

(b) a step of heating the copolymer solution obtained in the polymerization step (a) to a temperature from 100 °C to 300 °C and
(c) a step of removal of volatile components in a degassing apparatus.

13. Moulding composition comprising a copolymer according to any of Claims 1 to 4 and at least one additive selected from UV absorbers, UV stabilizers, anti-oxidants, colourants, flow improver, scattering aids, lubricants, demoulding aids or a combination of any of those.

14. Moulded article obtainable from a moulding composition according to Claim 13 by a process selected from injection moulding and extrusion.

15. Use of a moulded article according to Claim 14 as an optical element, lamp cover, preferably for room lighting systems or automobile lighting equipment, black coloured pillar trim, electronic component.