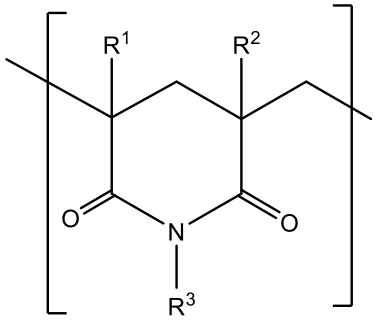
Claims

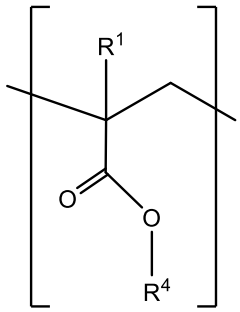
1. Polymer composition for tribological applications comprising a polymer matrix A, which comprises at least on one poly(meth)acrylimide, and at least one tribological additive B, selected from organic particulate fillers B1, inorganic particulate fillers B2 and reinforcing fibers B3, wherein the at least one poly(meth)acrylimide comprises:

i) from 1 to 95 wt.-%, preferably from 20 to 92 wt.-%, based on the total weight of the poly(meth)acrylimide, units of formula I



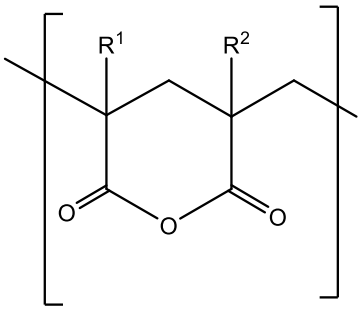

(I);

ii) from 1 to 70 wt.-%, preferably from 2 to 60 wt.-%, based on the total weight of the poly(meth)acrylimide, units of formula II



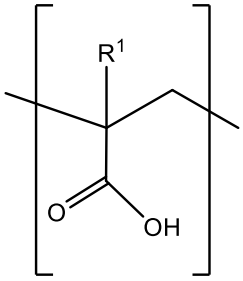

(II);

iii) from 1 to 20 wt.-%, preferably from 1 to 12 wt.-%, based on the total weight of the poly(meth)acrylimide, units of formula III




(III); and

iv) from 0 to 15 wt.-%, preferably from 0 to 10 wt.-%, based on the total weight of the poly(meth)acrylimide, units of formula IV




(IV),

wherein

$R^1$ and $R^2$ are, independently from each other, hydrogen or $C_1$-$C_6$ alkyl, preferably hydrogen or methyl;

$R^3$ is hydrogen, $C_1$-$C_{18}$-alkyl, $C_5$-$C_8$-cycloalkyl, $C_6$-$C_{10}$-aryl, or $C_6$-$C_{10}$-aryl-$C_1$-$C_4$-alkyl, where these radicals may be up to trisubstituted by radicals selected from the group consisting of $C_1$-$C_4$-alkyl, $C_1$-$C_4$-alkoxy and halogen; and

$R^4$ is $C_1$-$C_{18}$-alkyl, $C_5$-$C_8$-cycloalkyl, $C_6$-$C_{10}$-aryl, or $C_6$-$C_{10}$-aryl-$C_1$-$C_4$-alkyl, where these radicals may be up to trisubstituted by radicals selected from the group consisting of $C_1$-$C_4$-alkyl, $C_1$-$C_4$-alkoxy and halogen.

2. Polymer composition according to claim 1, comprising, in each case based on the total weight of the polymer composition:

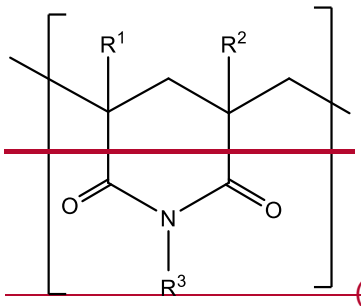
from 50 to 97 wt.-%, preferably 60 to 95 wt.-%, of the polymer matrix A;

from 3 to 30 wt.-%, preferably 5 to 25 wt.-%, of the at least one tribological additive B;

from 0 to 5 wt.-%, preferably 0 to 3 wt.-%, of at least one lubricant C;

from 0 to 20 wt.-%, preferably 0 to 10 wt.-%, of one or more further component D.

3. Polymer composition according to claim 1 or 2, wherein the polymer matrix A comprises at least 50 wt.-%, based on the polymer matrix A, of the at least one poly(meth)acrylimide., ~~and wherein the poly(meth)acrylimide contains units of formula (I)~~



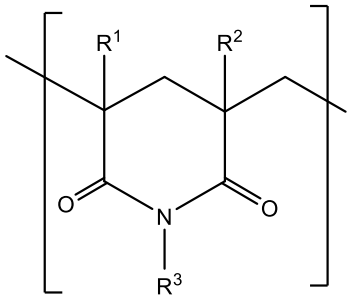

~~(I),~~

~~in which~~

~~$R^1$ and $R^2$ are, independently from each other, hydrogen or $C_1$-$C_6$-alkyl, preferably hydrogen or methyl; and~~

~~$R^3$ is hydrogen, $C_1$-$C_{18}$-alkyl, $C_5$-$C_8$-cycloalkyl, $C_6$-$C_{10}$-aryl, or $C_6$-$C_{10}$-aryl-$C_1$-$C_4$-alkyl, where these radicals may be up to trisubstituted by radicals selected from the group consisting of $C_1$-$C_4$-alkyl, $C_1$-$C_4$-alkoxy and halogen.~~

4. Polymer composition according to any of claims 1 to 3, wherein the at least one poly(meth)acrylimide comprises at least at least 5 wt.-%, preferably at least 15 wt.-%, more preferably at least 60 wt.-%, based on the total poly(meth)acrylimide, units of formula (I)




(I),

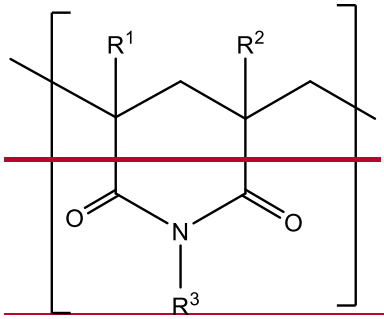
in which

$R^1$ and $R^2$ are, independently from each other, hydrogen or $C_1$-$C_6$ alkyl, preferably hydrogen or methyl; and

$R^3$ is hydrogen, $C_1$-$C_{18}$-alkyl, $C_5$-$C_8$-cycloalkyl, $C_6$-$C_{10}$-aryl, or $C_6$-$C_{10}$-aryl-$C_1$-$C_4$-alkyl, where these radicals may be up to trisubstituted by radicals selected from the group consisting of $C_1$-$C_4$-alkyl, $C_1$-$C_4$-alkoxy and halogen.

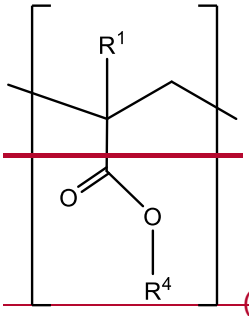
~~5. Polymer composition according to any of claims 1 to 4, wherein the at least one poly(meth)acrylimide comprises:~~

i) from 1 to 95 wt.-%, preferably from 20 to 92 wt.-%, based on the total weight of the poly(meth)acrylimide, units of formula I



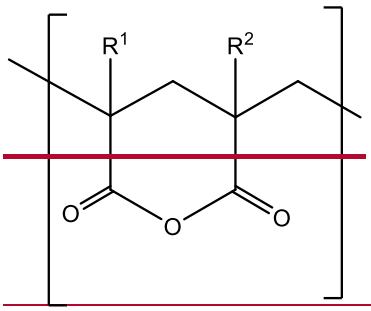

(I);

ii) from 1 to 70 wt.-%, preferably from 2 to 60 wt.-%, based on the total weight of the poly(meth)acrylimide, units of formula II



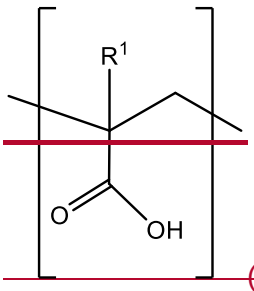

(II);

iii) from 1 to 20 wt.-%, preferably from 1 to 12 wt.-%, based on the total weight of the poly(meth)acrylimide, units of formula III




(III); and

iv) from 0 to 15 wt.-%, preferably from 0 to 10 wt.-%, based on the total weight of the poly(meth)acrylimide, units of formula IV




(IV),

~~wherein~~

~~$R^1$ and $R^2$ are, independently from each other, hydrogen or $C_1$-$C_6$-alkyl, preferably hydrogen or methyl;~~

~~$R^3$ is hydrogen, $C_1$-$C_{18}$-alkyl, $C_5$-$C_8$-cycloalkyl, $C_6$-$C_{10}$-aryl, or $C_6$-$C_{10}$-aryl-$C_1$-$C_4$-alkyl, where these radicals may be up to trisubstituted by radicals selected from the group consisting of $C_1$-$C_4$-alkyl, $C_1$-$C_4$-alkoxy and halogen; and~~

~~$R^4$ is $C_1$-$C_{18}$-alkyl, $C_5$-$C_8$-cycloalkyl, $C_6$-$C_{10}$-aryl, or $C_6$-$C_{10}$-aryl-$C_1$-$C_4$-alkyl, where these radicals may be up to trisubstituted by radicals selected from the group consisting of $C_1$-$C_4$-alkyl, $C_1$-$C_4$-alkoxy and halogen.~~

~~6~~5. Polymer composition according to any of Claim ~~3 to 5~~1 to 4, wherein $R^1$, $R^2$, $R^3$ and $R^4$ are methyl.

~~7~~6. Polymer composition according to any of Claims 1 to ~~6~~5, wherein the at least one tribological additive B comprises at least one organic particulate filler B1, wherein the organic particulate filler B1 is selected from polymer particles having a L/D ratio in the range from 1 to 3 and a particle diameter in the range of 1 to 100 µm, and wherein the polymer particles essentially consist of a polymer selected from polyphenylene sulfone, polytetrafluoroethylene, perfluoroalkoxy alkane polymers, tetrafluoroethylene/ethylene copolymers; and high molecular weight polyolefins.

~~8~~7. Polymer composition according to any of Claims 1 to ~~7~~6, wherein the tribological additive B is selected from polytetrafluoroethylene particles, graphite, boron nitride, molybdenum disulfide, tungsten disulfide, silicon nitride, silicon carbide, boron carbide, calcium carbonate, titanium dioxide, silicon dioxide, cerium dioxide, aluminum oxide, copper particles, silver particles, carbon fibers, glass fibers, and aramid fibers.

~~9~~8. Polymer composition according to any of Claims 1 to ~~8~~7, wherein the polymer composition comprises from 0.5 to 5 wt.-%, based on the total polymer composition, at least one liquid lubricant C, selected from silicon oils.

~~10~~9. Polymer composition according to any of Claims 1 to ~~9~~8, wherein the polymer composition comprises at least one further component D, selected from crosslinking agents, thermal stabilizers, UV absorbers, and impact modifiers.

~~11~~10. Polymer composition according to any of Claims 1 to ~~10~~9, wherein the polymer matrix A exhibits a Vicat softening temperature of at least 130 °C, preferably of at least 150°C, more preferably of at least 170 °C, determined according to ISO 306 (B50).

~~12~~11. Process for producing a polymer composition according to any of Claims 1 to ~~11~~10, wherein the process comprises mixing the polymer matrix A and the at least one tribological additive B, and optionally further components C and/or D.

~~13~~12. Formed article made of a polymer composition according to any of Claims 1 to ~~11~~10.

~~14~~13. Formed article according to Claim ~~13~~12, wherein the formed article is utilized in or in form of pump casings, pump parts, transmission control equipment, chain guides, sliding bearings, ball bearings, sliding shoes, gear wheels, gear drives, rolls, pistons, piston rings, piston rods, clutches, brakes, seals, membranes, fittings, bushings, casings, valve casings, or valve parts.

~~15~~14. Process for producing a formed article from a polymer composition according to any of Claims 1 to ~~11~~10, preferably via injection molding or extrusion.

~~16~~15. Process for producing a formed article according to claim ~~15~~14, wherein the process encompasses at least one step of crosslinking by exposing the polymer composition to radiation, preferably radiation selected from beta radiation, gamma radiation, electron beam, x-ray radiation, and UV/Vis radiation.