CLAIMS

1. A bitumen additive comprising :

a wax dispersed in water, the water being in the continuous phase and the wax in the dispersed phase;

the wax comprising a Fischer-Tropsch wax and one or more hydrocarbon waxes; and

an cationic emulsifier;

wherein the one or more hydrocarbon waxes is a petroleum slack wax;

wherein the wax comprises

20 wt% to 80 wt% of the petroleum slack wax; and

20 wt% to 80 wt% of the Fischer-Tropsch wax,

each relative to a total mass of the mixture of the Fischer-Tropsch wax and the petroleum slack wax.

wherein the Fischer-Tropsch wax has the following properties:

a congealing point according to ASTM D938 of 50°C or higher;

a MEK-oil content according to ASTM D7211-06 below 5 wt%;

a kinematic viscosity at 100°C according to ASTM D7042-11 from 3 mm^2/s to 15 mm^2s;

a needle penetration at 25°C according to ASTM D1321 below 30 1/10mm; and

a n-alkane content above 80 wt%;

wherein the petroleum slack wax has the following properties:

a congealing point according to ASTM D938 below 65°C;

a MEK-oil content according to ASTM D7211-06 above 5 wt%;

a kinematic viscosity at 100°C according to ASTM D7042-11 from 3.5 mm^2/s to 10 mm^2/s;

a needle penetration at 25°C according to ASTM D1321 above 50 1/10 mm; and

a n-alkane content below 70 wt%; and

wherein the bitumen additive comprises from 30 wt% to 70 wt% of the wax, based on the total mass of the bitumen additive.

2. The bitumen additive according to claim 1, wherein the bitumen additive additionally comprises fatty alcohols.

3. The bitumen additive according to claims 1 or claim 2, wherein the bitumen additive comprises from 0.2 wt% to 10 wt% of the emulsifier, preferably from 1 wt% to 6 wt% of the emulsifier, based on the total mass of the bitumen additive.

4. The bitumen additive according to any one of claims 1 to 4, wherein the bitumen additive comprises an elastomer, preferably from 1 wt% to 70 wt% of the elastomer, preferably from 20 wt% to 50 wt% of the elastomer, based on the total mass of the bitumen additive.

5. The bitumen additive according to any one of claims 1 to 4, wherein the Fischer-Tropsch wax has the following properties:

a congealing point according to ASTM D938 of 60°C or higher, preferably between 70°C and 110°C, more preferably between 75°C and 82°C;
a MEK-oil content according to ASTM D7211-06 below 2 wt%;
a kinematic viscosity at 100°C according to ASTM D7042-11 from 5 mm^2/s to 10 mm^2/s, more preferably from 7mm^2/s to 9 mm^2/s;
a needle penetration at 25°C according to ASTM D1321 below 10 1/10mm; and
a n-alkane content above 80 wt%.

6. The bitumen additive according to any one of claims 1 to 5, wherein the petroleum slack wax has the following properties:
a congealing point according to ASTM D938 below 65°C;
a MEK-oil content according to ASTM D7211-06 above 15 wt%;
a kinematic viscosity at 100°C according to ASTM D7042-11 from 5 mm^2/s to 10 mm^2/s, preferably from 6 mm^2/s to 8 mm^2/s;
a needle penetration at 25°C according to ASTM D1321 above 50 1/10 mm; and
a n-alkane content below 40 wt%.

7. A method to produce a warm asphalt mix, the method comprising:
adding a bitumen feedstock and the bitumen additive according to any one of claims 1 to 9 to an aggregate in an asphalt mixer thereby to produce the warm asphalt mix, wherein the bitumen feedstock

a. is added to the aggregate prior to adding the bitumen additive to the aggregate; or
b. is added to the aggregate concurrently with adding the bitumen additive to the aggregate.

8. The method according to claim 7, wherein the bitumen additive is added to the bitumen feedstock in an amount of from 0.1 wt% to 10 wt%, preferably from 2 wt% to 6 wt%, based on the total mass of the bitumen feedstock.

9. The method according to claim 7 or claim 8, where in the bitumen feedstock is foamed in the asphalt mixer when the bitumen feedstock is contacted with the bitumen additive.

10. The method according to any one of claims 7 to 9, wherein the additive is added directly to the asphalt mixer using a liquid additive dosing system.

11. The method according to any one of claims 7 to 9, wherein the bitumen additive is added to the bitumen feedstock in a bitumen foaming device thereby to form a foamed bitumen composition, and the foamed bitumen composition is then added to the aggregate in the asphalt mixer.

12. The method according to any one of claims 7 to 11, wherein the aggregate comprises recycled or reclaimed asphalt pavement (RAP).

13. Use of a foamed bitumen composition obtainable according to the method of claim 11 to produce a warm mix asphalt.

14. Use of the bitumen additive according to any one of claims 1 to 6 for producing a foamed bitumen composition.