Claims

1. Phenolic foam comprising a hydrocarbon blowing agent and alkali metal silicate present in an amount of at least 1% by weight, the foam having an aged thermal conductivity as determined by the procedures of EN13166:2008 or EN14314:2009 of less than 0.025W/m.K.

2. A foam as claimed in claims 1 wherein the foam is formed from a phenolic resin mixture having a water content of from about 12% by weight to about 24%, for example 15% by weight to about 24% by weight of the resin mixture.

3. A foam as claimed in claim 1 or claim 2 wherein the alkali metal silicate is present in an amount of from 1% to 10% by weight of the phenolic foam.

4. A foam as claimed in any of the preceding claims wherein the alkali metal silicate is present in an amount of from 2.5% to 5% by weight of the phenolic foam

5. A foam as claimed in any of claims 1 to 4 wherein the alkali metal silicate is hydrated and has the formula $A_2SiO_3 \cdot nH_2O$ in which A is an alkali metal from Group 1 of the Periodic Table and n is an integer from 1 to 9.

6. A foam as claimed in any of claims 1 to 5 wherein the alkali metal silicate is selected from one or more of the group comprising sodium silicate, potassium silicate and lithium silicate.

7. A foam as claimed in any of claims 1 to 6 wherein the silicate is sodium silicate pentahydrate

8. A foam as claimed in any of claims 1 to 6 wherein the silicate is potassium silicate.

9. A foam as claimed in any of claims 1 to 6 wherein the silicate is lithium silicate.

10. A foam as claimed in any of claims 1 to 9 wherein the hydrocarbon comprises at least one pentane.

11. A foam as claimed in claim 10 wherein the hydrocarbon comprises a mixture of cyclopentane and isopentane.

12. A foam as claimed in claim 10 wherein the hydrocarbon comprises a mixture of isopropyl chloride and isopentane.

13. A foam as claimed in any of claims 1 to 12 wherein the blowing agent comprises perfluoroalkane.

14. A foam as claimed in any of claims 1 to 13 wherein the foam is formed from a phenolic resole resin mixture having a water content of greater than 15% by weight but less than 24% by weight and the alkali metal silicate is present in an amount of at least 1% by weight of the foam.

15. A foam as claimed in claim 14 wherein the alkali metal silicate is present in the phenolic resole resin mixture excluding fillers in an amount of from 1% to 10% by weight of the foam.

16. A foam as claimed in claim 14 or 15 wherein the alkali metal silicate is present in the resole resin mixture (excluding fillers) in an amount of from 2.5% to 5% by weight of the foam.

17. A method of making a foam product the method comprising forming the foam from a composition comprising:

a phenolic resin including surfactant, catalyst, blowing agent and alkali metal silicate and optional fillers,

the composition excluding optional fillers having a water content of from about 15% to about 24% by weight of the composition,

to produce a closed cell foam product.

18. A method of making a foam product, the method comprising providing a composition comprising:

a phenolic resin including surfactant, catalyst, blowing agent and alkali metal silicate and optional fillers, and curing the foam to produce a closed cell foam product having an aged thermal conductivity as determined by the procedures of EN13166:2008 of less than 0.025W/m.K.

19. Use of an alkali metal silicate as an additive to a phenolic foam resin composition to produce a closed cell foam product the closed cell foam product having an aged thermal conductivity as determined by the procedures of EN13166:2008 of less than 0.025W/m.K.

20. A resin mixture for forming phenolic foam products, the resin mixture including, phenolic resin including surfactant, catalyst, blowing agent and alkali metal silicate but excludes optional fillers with a water content from about 15% to about 24% by weight.

21. Use of an alkaline metal silicate as a film-forming additive in the production of a closed cell foam to form a film within closed cells of the foam.

22. A method of making a closed cell foam product, the method comprising providing a composition comprising:

providing an alkali metal silicate in a resin mixture which can be cured to form a closed cell product in amount sufficient to form a film within closed cells of the foam.

Claims

1. Phenolic foam comprising a phenolic resin, a hydrocarbon blowing agent and alkali metal silicate present in an amount of at least 1% by weight of the foam, the foam having an aged thermal conductivity as determined by the procedures of EN13166:2008 or EN14314:2009 of less than 0.025W/m.K.

2. A foam as claimed in claims 1 wherein the foam is formed from a phenolic resin mixture having a water content of from about 12% by weight to about 24%, for example 15% by weight to about 24% by weight of the resin mixture.

3. A foam as claimed in claim 1 or claim 2 wherein the alkali metal silicate is present in an amount of from 1% to 10% by weight of the phenolic foam.

4. A foam as claimed in any of the preceding claims wherein the alkali metal silicate is present in an amount of from 2.5% to 5% by weight of the phenolic foam.

5. A foam as claimed in any of claims 1 to 4 wherein the alkali metal silicate is hydrated and has the formula $A_2SiO_3 \cdot nH_2O$ in which A is an alkali metal from Group 1 of the Periodic Table and n is an integer from 1 to 9.

6. A foam as claimed in any of claims 1 to 5 wherein the alkali metal silicate is selected from one or more of the group comprising sodium silicate, potassium silicate and lithium silicate.

7. A foam as claimed in any of claims 1 to 6 wherein the silicate is sodium silicate pentahydrate.

8. A foam as claimed in any of claims 1 to 6 wherein the silicate is potassium silicate.

9. A foam as claimed in any of claims 1 to 6 wherein the silicate is lithium silicate.

10. A foam as claimed in any of claims 1 to 9 wherein the hydrocarbon comprises at least one pentane.

11. A foam as claimed in claim 10 wherein the hydrocarbon comprises a mixture of cyclopentane and isopentane.

12. A foam as claimed in claim 10 wherein the hydrocarbon comprises a mixture of isopropyl chloride and isopentane.

13. A foam as claimed in any of claims 1 to 12 wherein the blowing agent comprises perfluoroalkane.

14. A foam as claimed in any of claims 1 to 13 wherein the foam is formed from a phenolic resole resin mixture having a water content of greater than 15% by weight but less than 24% by weight and the alkali metal silicate is present in an amount of at least 1% by weight of the foam.

15. A foam as claimed in claim 14 wherein the alkali metal silicate is present in the phenolic resole resin mixture excluding fillers in an amount of from 1% to 10% by weight of the foam.

16. A foam as claimed in claim 14 or 15 wherein the alkali metal silicate is present in the resole resin mixture (excluding fillers) in an amount of from 2.5% to 5% by weight of the foam.

17. A method of making a foam product the method comprising forming the foam from a composition comprising:

a phenolic resin including surfactant, catalyst, blowing agent and alkali metal silicate and optional fillers,

the composition excluding optional fillers having a water content of from about 15% to about 24% by weight of the composition,

to produce a closed cell foam product having an aged thermal conductivity as determined by the procedures of EN13166:2008 or EN14314:2009 of less than 0.025W/m.K.

18. A method of making a foam product, the method comprising providing a composition comprising:

a phenolic resin including surfactant, catalyst, blowing agent and alkali metal silicate and optional fillers, and curing the foam to produce a closed cell foam product having an aged thermal conductivity as determined by the procedures of EN13166:2008 of less than 0.025W/m.K.

19. Use of an alkali metal silicate as an additive to a phenolic foam resin composition to produce a closed cell foam product the closed cell foam product having an aged thermal conductivity as determined by the procedures of EN13166:2008 of less than 0.025W/m.K.

20. Use of an alkaline metal silicate as a film-forming additive in the production of a closed cell foam to form a film within closed cells of the foam.