CLAIMS

1. A gelling composition for forming a fire-resistant hydrogel interlayer within a glazing unit, the gelling composition obtained by mixing together:

5-40% w/w of a curable hydrogel-forming component comprising an acidic polymerisable monomer;

20-60% w/w of one or more salts;

40-90% w/w of an aqueous vehicle;

wherein the composition has an acidic pH greater than or equal to pH 1 and less than pH 7.

2. The gelling composition as claimed in claim 1, wherein the gelling composition is a curable gelling composition, which can be cured to form a polyelectrolyte hydrogel.

3. The gelling composition as claimed in any preceding claim, wherein the pH of the gelling composition is between 4 and 5.5.

4. The gelling composition as claimed in any preceding claim, wherein the gelling composition further comprises 0.02-0.08% w/w cross-linking agent.

5. The gelling composition as claimed in any preceding claim, wherein the one or more salts constitute 35-52% w/w of the gelling composition.

6. The gelling composition as claimed in any preceding claims, wherein the one or more salt(s) comprise magnesium sulphate.

7. The gelling composition as claimed in any preceding claims, wherein the one or more salt(s) comprise magnesium acetate.

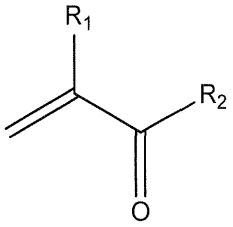
8. The gelling composition as claimed in any preceding claim, wherein the one or more salts are or include one or more metal salts including magnesium sulphate, magnesium oxide, and magnesium acetate.

9. The gelling composition as claimed in claim 8, wherein the gelling composition comprises:

- 5-35% w/w $MgSO_4.7H_2O$
- 0-3% w/w MgO
- 5-35% w/w $Mg(OAc)_2.4H_2O$.

10. The gelling composition as claimed in any preceding claim, wherein the gelling composition comprises 6-15% w/w hydrogel-forming component.

11. The gelling composition as claimed in any preceding claim, wherein the hydrogel-forming component comprises a polymerisable hydrophilic monomer, wherein the polymerisable monomer is an acrylate or alkylacrylate monomer of Formula (I):



(I)

wherein R_1 is H or (1-2C)alkyl;

R_2 is selected from OH, OR_3, NH_2, NHR_3, and NR_3R_4; and

R_3 and R_4 are independently (1-2C)alkyl;

or a salt thereof.

12. The gelling composition as claimed in claim 11 wherein the hydrogel-forming component is acrylic acid.

13. The gelling composition as claimed in claim 1, wherein the gelling composition comprises:

6-16% w/w acrylic acid;

20-60% w/w of one or more salts, including:

- 5-35% w/w (of composition as a whole) $MgSO_4.7H_2O$
- 0-3% w/w (of composition as a whole) MgO
- 5-35% w/w (of composition as a whole) $Mg(OAc)_2.4H_2O$;

40-90% w/w water;

0.02-0.08% w/w cross-linking agent;

0.001-0.05% w/w photoinitiator;

wherein the composition has a pH between 4 and 6.

14. A glazing unit comprising a first transparent pane and a second transparent pane with an interlayer disposed therebetween, wherein the interlayer is a hydrogel formed by curing the gelling composition as claimed in any of claims 1 to 13.

15. A process for forming a glazing unit, the process comprising:

i) providing a first and a second transparent pane;

ii) partially assembling the glazing unit such that the first and second transparent panes are spaced apart from one another and a sealing means holds the first and second panes in position; wherein;

the sealing means comprises an opening; and

the first and second panes and the sealing means together define an internal space;

iii) delivering a gelling composition as claimed in any of claims 1-13 into the internal space through the opening in the sealing means;

iv) closing the opening in the sealing means to provide a sealed internal space; and

v) curing the gelling composition to provide a hydrogel gel interlayer within the internal space;

wherein the gel is bonded to the inner surfaces of the first and/or second transparent panes by either coating at least one of the internal surfaces of the first and/or second panes with a coupling agent prior to step (iii) or incorporating the coupling agent into the gelling composition.

16. A method of manufacturing a gelling composition for forming a fire-resistant hydrogel interlayer within a glazing unit, comprising mixing together:

5-40% w/w of a curable hydrogel-forming component;

20-60% w/w of one or more salts;

40-90% w/w of an aqueous vehicle;

to form a gelling composition with an acidic pH greater than or equal to pH 1 and less than pH 7.

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wherein the composition has an acidic pH greater than or equal to pH 1 and less than pH 7.

2. The gelling composition as claimed in claim 1, wherein the gelling composition is a curable gelling composition, which can be cured to form a polyelectrolyte hydrogel.

3. The gelling composition as claimed in any preceding claim, wherein the pH of the gelling composition is between 4 and 5.5.

4. The gelling composition as claimed in any preceding claim, wherein the gelling composition further comprises 0.02-0.08% w/w cross-linking agent.

5. The gelling composition as claimed in any preceding claim, wherein the one or more salts constitute 35-52% w/w of the gelling composition.

6. The gelling composition as claimed in any preceding claims, wherein the one or more salt(s) comprise magnesium sulphate.

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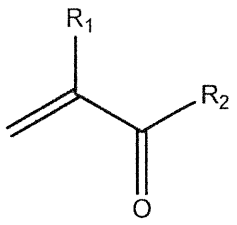
8. The gelling composition as claimed in any preceding claim, wherein the one or more salts are or include one or more metal salts including magnesium sulphate, magnesium oxide, and magnesium acetate.

9. The gelling composition as claimed in claim 8, wherein the gelling composition comprises:

- 5-35% w/w $MgSO_4.7H_2O$
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10. The gelling composition as claimed in any preceding claim, wherein the gelling composition comprises 6-15% w/w hydrogel-forming component.

11. The gelling composition as claimed in any preceding claim, wherein the hydrogel-forming component comprises a polymerisable hydrophilic monomer, wherein the polymerisable monomer is an acrylate or alkylacrylate monomer of Formula (I):



(I)

wherein R_1 is H or (1-2C)alkyl;

R_2 is selected from OH, OR_3, NH_2, NHR_3, and NR_3R_4; and

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or a salt thereof.

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- 5-35% w/w (of composition as a whole) $MgSO_4.7H_2O$
- 0-3% w/w (of composition as a whole) MgO
- 5-35% w/w (of composition as a whole) $Mg(OAc)_2.4H_2O$;

40-90% w/w water;

0.02-0.08% w/w cross-linking agent;

0.001-0.05% w/w photoinitiator;

wherein the composition has a pH between 4 and 6.

14. A glazing unit comprising a first transparent pane and a second transparent pane with an interlayer disposed therebetween, wherein the interlayer is a hydrogel formed by curing the gelling composition as claimed in any of claims 1 to 13.

15. A process for forming a glazing unit, the process comprising:

i) providing a first and a second transparent pane;

ii) partially assembling the glazing unit such that the first and second transparent panes are spaced apart from one another and a sealing means holds the first and second panes in position; wherein;

the sealing means comprises an opening; and

the first and second panes and the sealing means together define an internal space;

iii) delivering a gelling composition as claimed in any of claims 1-13 into the internal space through the opening in the sealing means;

iv) closing the opening in the sealing means to provide a sealed internal space; and

v) curing the gelling composition to provide a hydrogel gel interlayer within the internal space;

wherein the gel is bonded to the inner surfaces of the first and/or second transparent panes by either coating at least one of the internal surfaces of the first and/or second panes with a coupling agent prior to step (iii) or incorporating the coupling agent into the gelling composition.

16. A method of manufacturing a gelling composition for forming a fire-resistant hydrogel interlayer within a glazing unit, comprising mixing together:

5-40% w/w of a curable hydrogel-forming component;

20-60% w/w of one or more salts;

40-90% w/w of an aqueous vehicle;

to form a gelling composition with an acidic pH greater than or equal to pH 1 and less than pH 7.

and monitoring the integrity of the glazing, and/or temperature levels on the opposing side of the glazing, over time.

[0007] Fire resistant glazing in which the internal space between the transparent glass panes is filled with an interlayer of aqueous fire-resistant gel are described in US 4264681 (SAINT GOBAIN), WO 03/061963 (FLAMRO), and WO 2009/071409 (FLAMRO). Fire resistant glazing comprising silicate based fire-resistant interlayers are also known (see, for example, WO2008/084083 (PILKINGTON)). These are commonly referred to either as glazing units or glazing laminates.

[0008] However, there remains a need for new and improved fire resistant glazing. In particular, there is a growing need for fire resistant glazing that meets the most stringent fire resistant criteria. Commonly, in Europe this means that the glazing maintains its integrity provides a barrier from radiation emitted (the radiation measured at 1 m from the sample is to remain below 15 kW/m^2) and provides insulation from the fire (the temperature of the cold side of the glazing unit remains less than 140 °C on average and no individual spot exceeds a temperature of 180 °C above ambient) for a minimum of 10 minutes or more but usually for much longer. In addition, there are emerging market requirements for glazing that can maintain its integrity and radiation reduction for over 60 mins.

[0009] It is therefore an object of the present invention to provide glazing units that meet these stringent fire resistant criteria. Specifically, the object of the present invention is to provide glazing units which provide excellent insulation whilst also providing an excellent integrity and radiation barrier extending beyond the duration of insulation.

SUMMARY OF THE INVENTION

[0010] In accordance with a first aspect of the present invention, there is provided a gelling composition (preferably suitable for forming a fire-resistant hydrogel interlayer within a glazing unit), the gelling composition obtained by mixing together:

5-40% w/w of a curable hydrogel-forming component comprising an acidic polymersiable monomer;

20-60% w/w of one or more salts;

40-90% w/w of an aqueous vehicle;

wherein the composition has an acidic pH greater than or equal to pH 1 and less than pH 7.