matrix and a textile reinforcing mesh, making it possible to produce a hardened composite structure that is mechanically efficient, in which the hardenable matrix is a dry composition (e.g. cementitious) resulting, after mixing with a liquid (e.g. water), in an easily sprayable wet formulation that is easy to use, having a paste-like consistency and viscosity enabling pumping by a gun and sufficiently long workability to perform the mixing and application of the consolidation structure, while remaining cost-effective, and stable after mixing.

(xiii) Providing a composite structure obtained using the system as set out in aims (i) to (xii) above, that is mechanically efficient, easy to produce in a variety of contexts, and cost-effective.

(xiv) Providing a composite structure obtained using the system as set out in aims (i) to (xii) above, that can be used to increase the resistance to seismic loads of structures made from reinforced concrete or masonry.

(xv) Providing a method for consolidating structures made from reinforced concrete or masonry, by means of the system as set out in aims (i) to (xii) above, that is easy to implement in a variety of contexts, while remaining cost-effective.

Brief description of the invention

It is to the inventors' credit that they have highlighted that one of the key points for this type of matrix/textile reinforcement composite structures lies in optimising the anchoring of the matrix in the textile reinforcement. In particular, the inventors have noted that it is important to have good interpenetration and regular interpenetration of the cementitious matrix through the openings in the reinforcing fabric. Homogeneous trapping of the reinforcing fabric by the cementitious matrix is a way of preventing mechanical shear phenomena, which are capable of reducing the consolidation sought to zero.

Backed by these findings, the inventors are proposing a solution to the problem set out in all or some of the aims listed above. This solution lies at least partly in the use of a textile reinforcement comprising means of geometric and dimensional stabilisation of the network.

It follows that the present invention relates, in a first aspect thereof, to a composite system for consolidating structures, in particular structures made from reinforced concrete or masonry, comprising a hardenable or hardened matrix and a textile reinforcing mesh, in which the mesh comprises at least one layer formed:

- by a reinforcement constituted by flat warp threads and weft threads;
- and by a binding network of the reinforcement;

characterized in that the binding network is such that it ensures the dimensional stability under stress of the links of the reinforcement, before the mesh is applied to the structure to be consolidated;

in that the threads of the mesh is coated/impregnated with at least one polymer;

in that the mesh is coated which makes it possible to "fix" the assembly during the process of producing the mesh;

in that the weft threads and the warp threads of the reinforcement are comprised in two parallel planes;

and in that the matrix comprises one or more mineral binders at least partly constituted by cement, and possibly one or more organic binders.

This particular binding network according to the invention makes it possible to obtain, ultimately, a composite structure for consolidating structures, in particular structures made from reinforced concrete or masonry, having the required mechanical properties in terms of strength and ductility, in terms of bonding to the substrate to be consolidated and in terms of ease of use and storage.

According to other aspects thereof, the invention relates to the following elements taken individually and independently of each other: the textile reinforcing mesh, the hardenable matrix in the form of a dry composition and the hardened composite matrix/mesh structure applied to the structure to be consolidated.

In particular, the invention relates to a composite structure having a tensile modulus of elasticity TME less than or equal to - MPa where, in increasing order of preference - is 100,000, 80,000, 70,000.

According to another aspect thereof, the invention relates to a composite structure having a tensile modulus of elasticity TME less than or equal to 100,000 MPa, to increase the resistance to seismic loads of a reinforced concrete or masonry structure, said structure being obtained based on a composite system for consolidating structures, comprising a hardenable or hardened matrix and a textile reinforcing mesh, in which the mesh comprises at least one layer formed by a reinforcement constituted by flat warp threads and weft threads and has dimensional stability under stress of the links of the reinforcement, before the mesh is applied to the structure to be consolidated.

According to another aspect thereof, the invention also relates to a method for consolidating a structure, characterized in that it consists of press-mounting the mesh according to the invention on the structure with the matrix according to the invention, after having mixed said matrix with a liquid, preferably water, to obtain a hardenable wet matrix.

Herein disclosed is a wet formulation comprising the matrix according to the invention, mixed with a liquid, preferably water, as well as a method for preparing this wet formulation.

According to another aspect thereof, the invention relates to the use of a mesh according to the invention for consolidating a structure, in particular a reinforced concrete or masonry structure, by press-mounting using a wet formulation comprising a mix of water and of the matrix including (in parts by weight on dry basis):

- 100 of binder;
- 1 – 4,000, and in increasing order of preference, 5 – 2,000; 10 – 1,000; 20 - 500 of mineral fillers;
- 0.01 - 1,000, and in increasing order of preference, 0.05 – 800; 0.1 - 500; 0.5 - 200; 1 – 50 of at least one resin;
- 0 - 500 of additives, preferably 0.01 – 50.

CLAIMS

1. Composite system for consolidating structures, in particular of reinforced concrete or masonry, comprising a hardenable or hardened matrix and a textile reinforcing mesh, in which the mesh comprises at least one layer formed:
   - by a reinforcement constituted by flat warp threads and weft threads;
   - and, by a binding network of the reinforcement;

   characterized in that the binding network is such that it ensures the dimensional stability under stress of the links of the reinforcement, before the mesh is applied to the structure to be consolidated;
   in that the threads of the mesh is coated/impregnated with at least one polymer;
   in that the mesh is coated which makes it possible to "fix" the assembly during the process of producing the mesh;
   in that the weft threads and the warp threads of the reinforcement are comprised in two parallel planes;
   and in that the matrix comprises one or more mineral binders at least partly constituted by cement, and possibly one or more organic binders.

2. System according to claim 1, characterized in that the dimensional stability under stress is qualified as follows in a test **ST**:
   The deformation of a 40x40 cm sample suspended by its two top corners in a vertical plane and subjected to the tensile stress of a 1 kg (deformation D1) or 2 kg (deformation D2) weight attached to the middle of the bottom edge of the sample, is such that:
   - D1 is less than or equal to 2.5 cm;
   - D2 is less than or equal to 5 cm.

3. System according to claims 1 or 2, characterized in that the at least one polymer which coats/impregnates the threads of the mesh is (are) selected from the group comprising, or even better constituted by:
   - (meth)acrylic (co)polymers, advantageously selected from the sub-group comprising, or even better constituted by, alkylester copolymers advantageously comprising 1 to 8 carbon atoms, with acrylic acid, or methacrylic acid, in particular those selected from the family comprising, or even better constituted by, preferably methyl acrylate, ethyl acrylate, butyl acrylate, 2-ethyl hexyl acrylate and correspondents thereof with methacrylic acid; and mixtures thereof;

- vinyl ester (co)polymers advantageously selected from the sub-group comprising, or even better constituted by, vinyl acetate homopolymers and copolymers, in particular those selected from the family comprising, or even better constituted by, vinyl and ethylene acetate copolymers, vinyl chloride (co)polymers such as vinyl and ethylene chloride copolymers, vinyl laurate (co)polymers, vinyl versatate (co)polymers, vinyl ester (co)polymers of alpha-monocarboxylic acids, saturated or not, branched or not, advantageously comprising 9 or 10 carbon atoms, homopolymers of alkyl carboxylic acid vinyl esters, saturated or not, branched or not, advantageously comprising from 3 to 8 carbon atoms, copolymers of these latter homopolymers with ethylene, vinyl chloride, and/or other vinyl esters; and mixtures thereof;
- styrene (co)polymers with butadiene or with one or more acrylic esters advantageously selected from the sub-group comprising, or even better constituted by, ethylenically unsaturated alkyl esters advantageously comprising from 1 to 8 carbon atoms of (meth)acrylic acid, preferably methyl acrylate, ethyl acrylate, butyl acrylate, 2-ethyl hexyl acrylate and correspondents thereof with methacrylic acid, and mixtures thereof;
- hot-melt (co)polymers, advantageously selected from the sub-group comprising, or even better constituted by, polyethylenes, polypropylenes, polyesters, polyamides, Ethylene Propylene Diene Monomer (EPDM) copolymers, and mixtures thereof;
- and mixtures thereof.

4. System according to at least one of claims 1 to 3, characterized in that the binding network of the reinforcement is a weave constituted by warp elements and weft elements, and in that this weave is a leno weave, each warp element of this weave comprising at least two binding threads, preferably two, and each weft element of this weave comprising at least one binding thread, preferably one.

5. System according to claim 4, characterized in that:
   - each warp element of the weave comprises two warp binding threads and each weft element of the weave comprises one weft binding thread,
   - one of the two warp binding threads passes on the same side C1 of all of the weft threads of the reinforcement,
   - the other warp binding thread passes on the same side C2, opposite C1, of all of the weft threads of the reinforcement,

- between two successive weft threads of the reinforcement, the warp binding threads intersect before the weft binding thread, pass on either side of weft binding thread and then intersect again to clasp the weft thread of the reinforcement.

6. System according to at least one of claims 1 to 5, characterized in that the hardenable matrix comprises (in parts by weight on dry basis):
    - 100 of binder;
    - 1 – 4,000, and in increasing order of preference, 5 – 2,000; 10 – 1,000; 20 - 500 of mineral fillers;
    - 0.01 - 1,000, and in increasing order of preference, 0.05 – 800; 0.1 - 500; 0.5 - 200; 1 – 50 of at least one resin;
    - 0 - 500 of additives, preferably 0.01 – 50.

7. Consolidation mesh for structure made from reinforced concrete or masonry, characterized in that it comprises at least one layer formed:
    - by a reinforcement constituted by flat warp threads and weft threads;
    - and by a binding network of the reinforcement;

    and in that the binding network is such that it ensures the geometric regularity and dimensional stability of the links of the reinforcement, before the mesh is applied to the structure to be consolidated;
    in that the threads of the mesh is coated/impregnated with at least one polymer;
    in that the mesh is coated which makes it possible to "fix" the assembly during the process of producing the mesh;
    in that the weft threads and the warp threads of the reinforcement are comprised in two parallel planes;
    and in that the matrix comprises one or more mineral binders at least partly constituted by cement, and possibly one or more organic binders.

8. Hardened composite structure obtained using the system according to at least one of claims 1 to 6.

9. Composite structure according to claim 8, characterized by a tensile modulus of elasticity TME less than or equal to 100,000 MPa.

10. Use of a composite structure having a tensile modulus of elasticity TME less than or equal to 100,000 MPa, to increase the resistance to seismic loads of a reinforced concrete or masonry structure, said composite structure being obtained based on a

composite system for consolidating structures, comprising a hardenable or hardened matrix and a textile reinforcing mesh, in which the mesh comprises at least one layer formed by a reinforcement constituted by flat warp threads and weft threads and has dimensional stability under stress of the links of the reinforcement, before the mesh is applied to the structure to be consolidated.

11. Method for consolidating structures made from reinforced concrete or masonry characterized in that it essentially consists of press-mounting the mesh as defined in at least one of claims 1 to 5 or 7 to the structure with the matrix as defined in claim 1 or 6 after mixing said matrix with a liquid, preferably water, to obtain a hardenable wet matrix.

12. Method according to claim 11, characterized in that the hardenable wet matrix is sprayed onto the structure, preferably by means of a gun, the mesh is then positioned on the unhardened matrix and press-mounted, preferably using a trowel, and optionally the matrix is sprayed at least once more, preferably smoothing the surface of the matrix sprayed in this way with the trowel.

13. Method according to claim 12, characterized in that the operations of spraying, positioning another mesh and press-mounting are repeated n times, with n comprised between 1 and 3; these operations can be carried out on the surface of the unhardened or at least partly hardened previously sprayed matrix.

14. Use of a mesh according to claim 7, or to which claim 1 relates, for consolidating in particular a reinforced concrete or masonry structure by press-mounting, using a wet formulation comprising a mix of water and of the matrix including (in parts by weight on dry basis):

- o 100 of binder;
- o 1 – 4,000, and in increasing order of preference, 5 – 2,000; 10 – 1,000; 20 - 500 of mineral fillers;
- o 0.01 - 1,000, and in increasing order of preference, 0.05 – 800; 0.1 - 500; 0.5 - 200; 1 – 50 of at least one resin;
- o 0 - 500 of additives, preferably 0.01 – 50.