capillary porosity (water) that may locally increase the concentration of chloride ions, reducing or perhaps even removing the concentration gradient that is driving the diffusion. Conversely, for the samples cured for 28 days, where the hydration is much more complete, a trend of an increasing penetration depth with exposure time was generally observed.

[0049] The diffusive transport modifiers of aspects of the present invention are shown to decrease the diffusion rates of ingressing ions such as chlorides. Even though only chloride penetration was tested in the examples, other ions such as sulfates and other deleterious species as are known in the art may also exhibit decreased diffusion rates. An increase of the viscosity of the pore solution may also reduce other modes of ingress from the external environment into the concrete, such as sorption and flow under pressure (permeation). While an increase in viscosity may not change the permeability coefficient of the concrete microstructure, the flow rate of a fluid within the concrete due to a pressure gradient may be inversely proportional to the viscosity of the flowing fluid. Additionally, the sorptivity coefficient of a porous material may be proportional to one over the square root of the solution viscosity. Therefore, a higher viscosity may yield a lower sorption rate, during wet/dry cycling, for example. This assumes that the admixture may precipitate and redissolve during wet/dry cycling, as supported by experimental data in Table 3. Thus, the advantages provided by the addition of diffusive transport modifiers with respect to diffusion may also be present for flow under pressure and for sorption, two of the other common mechanisms of transport into and through concrete.

[0050] It is anticipated that concentrations of diffusive transport modifiers in the wet concrete mixture as low as 5% by weight (mass additive/mass water) will have the desired effect of increasing service life of concrete. However, in an advantageous aspect of the present invention, diffusive transport modifiers are incorporated into the wet concrete mixture at a concentration of at least 7.5% by weight, and more advantageously the concentration is at least 10% by weight. Additionally, the diffusive transport modifier may be comprised of a combination of constituents that exhibit the desired properties and effects.

[0051] It should be understood that the foregoing relates to exemplary aspects of the invention and that modifications may be made without departing from the spirit and scope of the invention as set forth in the following claims.

1. A process of making concrete having an increased service life comprising:

providing at least one organic water soluble diffusive transport modifying material;

mixing said at least one organic water soluble diffusive transport modifying material with water, at least one cementing agent, and at least one aggregate to form a wet mixture, said at least one organic water soluble diffusive transport modifying material being present in an amount sufficient to increase the viscosity of water by at least 25%; and

curing said wet mixture forming concrete having pores containing a pore solution;

said pore solution having an amount of said at least one water soluble diffusive transport modifying material suitable to reduce the ion diffusivity coefficient by at least 20%.

2. The process of claim **1** wherein said at least one organic water soluble diffusive transport modifying material has a molecular weight of at most 1,000 g/mol.

3. The process of claim **1** wherein said wet mixture has more than 5% by weight of said at least one organic water soluble diffusive transport modifying material.

4. The process of claim **1** wherein said pore solution has at least about 10% by weight of said at least one organic water soluble diffusive transport modifying material.

5. The process of claim **1** wherein said at least one organic water soluble diffusive transport modifying material is suitable to reduce electrical conductivity of a 0.1 mol KCl/kg water solution by about at least 20%.

6. The process of claim **1** wherein said at least one aggregate has a porous aggregate portion, said at least one water soluble diffusive transport modifying material being mixed with said porous aggregate portion prior to said step of mixing said at least one organic water soluble diffusive transport modifying material with said water, said at least one cementing agent and said at least one aggregate to form said wet mixture.

7. The process of claim **1** wherein said curing step comprises curing said wet mixture for at least 7 days prior to exposure to an external environment having elevated levels of deleterious species.

8. The process of claim **1** wherein said curing step comprises curing said wet mixture for at least 28 days prior to exposure to an external environment having elevated levels of deleterious species.

9. The process of claim **1** wherein said at least one soluble diffusive transport modifying material is suitable to resolubilize with water after a wet/dry cycle.

10. A structural concrete article made from the process of claim **1** having an increased service life of at least 20%.

11. Structural concrete having an extended service life comprising:

at least one aggregate,

water,

at least one cementing agent, and

at least one organic water soluble diffusive transport modifying material having a molecular weight of at most 1,000 g/mol and at a concentration suitable for reducing electrical conductivity of a 0.1 mol KCl/kg water solution by about at least 20% in a pore solution in said structural concrete.

12. The structural concrete of claim **11** wherein said at least one organic water soluble diffusive transport modifying material is present in said pore solution in an amount sufficient to increase the viscosity of said pore solution by at least 25%.

13. The structural concrete of claim **11** having steel reinforcing bars therein.

14. The structural concrete of claim **11** having an extended service life of at least 20% over a like comprised concrete not having said at least one organic water soluble diffusive transport modifying material when said structural concrete is exposed to an external environment having elevated levels of deleterious species.

15. A process for making concrete comprising the steps of:

mixing a porous aggregate with a solution having at least one organic water soluble diffusive transport modifying material providing a pre-wetted aggregate material;