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Structure and properties of aerated concrete: a review

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Abstract

Aerated concrete is relatively homogeneous when compared to normal concrete, as it does not contain coarse aggregate phase, yet shows vast variation in its properties. The properties of aerated concrete depend on its microstructure (void–paste system) and composition, which are influenced by the type of binder used, methods of pore-formation and curing. Although aerated concrete was initially envisaged as a good insulation material, there has been renewed interest in its structural characteristics in view of its lighter weight, savings in material and potential for large scale utilisation of wastes like pulverised fuel ash. The focus of this paper is to classify the investigations on the properties of aerated concrete in terms of physical (microstructure, density), chemical, mechanical (compressive and tensile strengths, modulus of elasticity, drying shrinkage) and functional (thermal insulation, moisture transport, durability, fire resistance and acoustic insulation) characteristics. © 2000 Elsevier Science Ltd. All rights reserved.

Keywords: Aerated concrete; Structure; Engineering properties; Fire resistance; Water absorption; Durability

1. Introduction

Aerated concrete is either a cement or lime mortar, classified as lightweight concrete, in which air-voids are entrapped in the mortar matrix by means of a suitable aerating agent. Broadly speaking aerated concrete falls into the group of cellular concrete (microporite being the other). The prominent advantage of aerated concrete is its lightweight, which economises the design of supporting structures including the foundation and walls of lower floors. It provides a high degree of thermal insulation and considerable savings in material due to the porous structure. By appropriate method of production, aerated concrete with a wide range of densities (300–1800 kg/m^3) can be obtained thereby offering flexibility in manufacturing products for specific applications (structural, partition and insulation grades). There have been several investigations on the properties of aerated concrete in the past. The first comprehensive review on aerated concrete was presented by Valore [1,2] and detailed treatment by Rudnai [3] and Short and Kinniburgh [4]. Although aerated concrete was initially envisaged as an insulation material, there has been renewed interest on its structural characteristics in view of its lighter weight, savings in material and potential for large scale utilisation of wastes like pulverised fuel ash. Hence, it was felt essential to compile and review the available literature on aerated concrete. This review aims to classify the studies on aerated concrete related to its material structure and properties.

2. Classification of aerated concrete

2.1. Based on the method of pore-formation

Air-entraining method (*gas concrete*): Gas-forming chemicals are mixed into lime or cement mortar during the liquid or plastic stage, resulting in a mass of increased volume and when the gas escapes, leaves a porous structure. Aluminium powder, hydrogen peroxide/bleaching powder and calcium carbide liberate hydrogen, oxygen and acetylene, respectively. Among these, aluminium powder is the most commonly used aerating agent. Efficiency of aluminium powder process is influenced by its fineness, purity and alkalinity of cement, along with the means taken to prevent the escape of gas

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before hardening of mortar. In the case of Portland cements with low alkalinity, addition of sodium hydroxide or lime supplement the alkali required.

Foaming method (*foamed concrete*): This is reported as the most economical and controllable pore-forming process [1,3] as there are no chemical reactions involved. Introduction of pores is achieved through mechanical means either by pre-formed foaming (foaming agent mixed with a part of mixing water) or mix foaming (foaming agent mixed with the mortar). The various foaming agents used are detergents, resin soap, glue resins, saponin, hydrolysed proteins such as keratin etc.

Combined pore-forming method: Production of cellular concrete by combining foaming and air-entraining methods has also been adopted using aluminium powder and glue resin [3].

2.2. Based on the type of binder

Aerated concrete is classified into cement or lime based depending on the binder used. Attempts have also been made to use pozzolanic materials such as pulverised fuel ash [3,5–9] or slate waste [10–12] as partial replacement to the binder or sand.

2.3. Based on the method of curing

Aerated concrete can be non-autoclaved (NAAC) or autoclaved (AAC) based on the method of curing. The compressive strength, drying shrinkage, absorption properties etc. directly depend on the method and duration of curing. The strength development is rather slow for moist-cured products. Autoclaving initiates reaction between lime and silica/alumina bearing ingredients. The hydrothermal reactions involved in autoclaving have been explained [13,14]. There exists wide variation in the pressure and duration suggested by various authors (duration – 8–16 h, and pressure – 4–16 MPa) [1,15,16]. The other variables of significance are the age and condition of the mix at the start of the curing cycle and rates of change of temperature and pressure. Autoclaving is reported to reduce the drying shrinkage significantly [1,17] and is essential if aerated concrete products are required within acceptable levels of strength and shrinkage [18].

3. Properties of aerated concrete

Table 1 gives an overview of the salient research with respect to the structure and properties of aerated concrete.

4. Physical properties

4.1. Microstructure

In aerated concrete, the method of pore-formation (viz., gas release, or foaming) influences the microstructure, and thus its properties. The material structure of aerated concrete is characterised by its solid microporous matrix and macropores. The macropores are formed due to the expansion of the mass caused by aeration and the micropores appear in the walls between the macropores [19]. Macropores have been envisaged as pores with a diameter of more than 60 μm [20]. The orientation of the products of hydration of cement is significantly altered due to the presence of voids.

The porous system of aerated concrete is also classified in terms of pore size distribution functions as artificial air pores, inter-cluster pores and inter-particle pores and the distribution of pores in the matrix has bearing on its properties [21]. Another well accepted method classify in terms of pores with radius of 50–500 μm, (pores of 5 μm size are considered as large pores in ordinary mortar) introduced by aerating or surface-active agents, microcapillaries of 50 nm or less formed in the walls between the air pores (referred as micropores [19]) and very few pores of 50 nm to 50 μm, called macrocapillaries [22]. Figs. 1(a)–(c) show the typical pore systems in aerated concrete [23]. Although the air-void system remains largely identical, there exists difference in the structure of AAC and NAAC, caused by the variation in the hydration products, which explains the variation in their properties. On autoclaving, a part of the fine siliceous material reacts chemically with calcareous material like lime and lime liberated by cement hydration, forming a microcrystalline structure with much lower specific surface. Tada and Nakano [22] points out that NAAC has a larger volume of fine pores due to the presence of excessive pore water. It has been observed that macropore size distribution does not have much influence on compressive strength [19].

Porosity, pore size distribution and permeability: Properties of concrete such as strength, permeability, diffusivity, shrinkage and creep are intimately related to its porosity and pore size distribution. Thus, the characterisation of the pore structure is extremely important, and more so in the case of aerated concrete where the porosity may be as high as 80%. Porosity and pore size distribution of aerated concrete varies considerably with the composition and method of curing. Higher porosity of aerated concrete has been established to be the consequence of increase in macropore volume [19] which in turn result in thinner pore walls, thereby reducing the micropore volume share. It has also been brought out that the porosity must be qualified with the pre-treatment method adopted, as oven drying of the sample to

Table 1
Overview of salient literature pertaining to the structure and properties of aerated concrete

Reference	Parameters studied													Salient features of the study
	Ingredients[a]		Method of aeration		Curing method[b]		Properties					Micro-structure	Chemical composition	
	Binder	Filler	Gas	Foam	mc	ac	Density	Strength	Shrinkage	Porosity	Functional Proportion			
[1,2]	C,L	S	✓	✓	✓	✓	✓	✓	✓		✓			Review on the properties
[40]	C	S	✓			✓		✓		✓				Strength–porosity relation
[29]	C	S	✓			✓							✓	Anomalous tobermorite
[42]	C	S	✓			✓			✓			✓		Micropore-shrinkage
[19]	C	S	✓			✓			✓	✓		✓		Structure-mech. properties
[12]	C,W	S	✓			✓	✓	✓		✓				Use of slate waste
[57]	C	S	✓			✓					✓			Fire resistance and acoustics
[17]	C	S	✓	✓		✓			✓					Shrinkage behaviour
[22]	C	S	✓	✓	✓							✓		Micro and macrocapillaries
[21]	C	S	✓	✓		✓				✓	✓	✓		Structure & water absorption
[6]	L	F	✓	✓		✓	✓	✓						Lime-fly ash cellular concrete
[37]	C	S		✓	✓			✓						Strength – composition
[46]	C	S	✓			✓			✓			✓		Micropore-shrinkage
[8]	C	F	✓			✓	✓	✓				✓		Density change-pore structure
[43]	C	S	✓			✓				✓	✓	✓		Pore structure, properties
[32]	C	S	✓			✓		✓				✓		Pore size- strength
[5]	C,L	F	✓		✓	✓	✓	✓						Fly ash cellular concrete
[51]	C	S	✓			✓					✓			Thermal conductivity
[30]	C	Q	✓			✓		✓					✓	Particle size on properties
[28]	C	S	✓			✓	✓	✓						Carbonation
[7]	C	F		✓	✓			✓		✓				Strength – Gel–space ratio

[a] C – cement, L – lime, S – sand, F – fly ash, Q – quartz, W – slate waste.
[b] mc – moist-curing, ac – autoclaving.

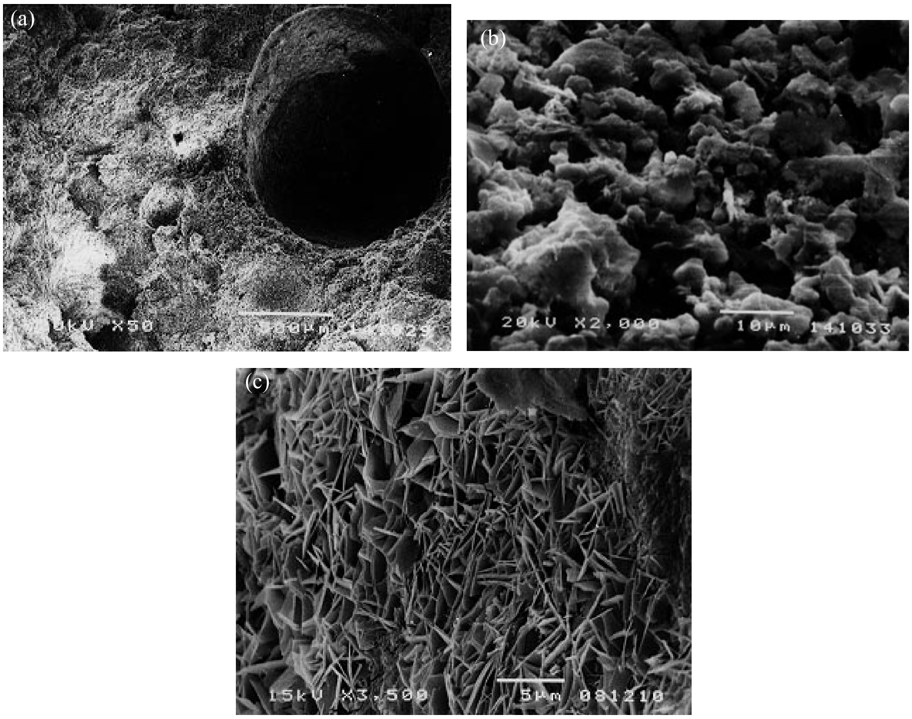

Fig. 1. Pore systems in aerated concrete: (a) artificial air pore; (b) inter-cluster pore; (c) inter-particle pore.

determine the porosity is reported to have led to collapse of the cell structure [24]. Although the porosity varies considerably between AAC made with foaming and gas forming methods, the permeability is not found to vary much. The artificial air pores were found to have little influence on permeability [25].

4.1.1. Methods to determine structure and porosity

Scanning electron microscopy (*SEM*): The use of high-resolution SEM is a precise method to determine the pore size and their distribution in cellular materials. The micrographs give a qualitative estimate of the total porosity, and also aid in determining the structure of compounds formed after the hydration of cement [21,22].

Automatic image analysis: This method facilitates determination of larger pores in the matrix of aerated concrete and helps in characterizing the pore size distribution. A video camera equipped with a special optical system is used to produce an image of the structure that can be processed with the help of special computing/digitizing technique. An image processor converts the analog image into a digital one [20].

Mercury intrusion porosimetry (*MIP*): Mercury intrusion is generally carried out at a pressure of around 200 MPa, which corresponds to a minimum pore diameter of 75 Å. The fundamental equation for surface tension has been modified and used to find the pore diameter penetrated by mercury. Integral and differential pore size distributions compiled on the basis of results of mercury porosimetry and automatic image analysis have been reported [21]. Artificial air pores, which are larger in size, cannot be characterized by this method.

Gas permeability: The type, size and distribution of pores are mainly responsible for permeability. Thus, the measurement of gas permeability indirectly charcterises the pore structure of AAC [26]. Only those pores, which are continuous and permit the gases to flow through the entire thickness of the material, are significant for gas permeability. The difference in evolution of porous structure caused by various manufacturing methods can be identified by this method.

4.2. Density

The water–cementitious materials ratio is related to the amount of aeration obtained and thus the density. For a given density, water–cement ratio increases with proportion of sand. For AAC with pozzolans, water–solids ratio appears to be more important than the water–cementitious ratio, irrespective of the method of pore-formation. For gas concrete, a lesser water–solids ratio leads to insufficient aeration while a higher one results in rupture of the voids, increase in density being the consequence in both the cases [27]. Thus the water requirement is to be gauged by consistency of the fresh mix rather than by a pre-determined water–cement or water–solids ratio [2,3].

As many physical properties of aerated concrete depend on the density (300–1800 kg/m^3), it is essential that its properties be qualified with density. While specifying the density, the moisture condition (i.e., oven-dry condition or at equilibrium with atmosphere) needs to be indicated. The material as delivered from autoclave may be 15–25% heavier than oven-dry material. This value can be as high as 45% for very low density aerated concrete [16]. A significant increase in the density of AAC with changing relative humidity and temperature is reported and is attributed to the carbonation process, this increase being proportional to the initial dry density [28].

As stated earlier, aerated concrete with a wide range of densities for specific applications can be manufactured by varying the composition, which in turn affects the pore structure, size and distribution. A stable and preferably spherical cell structure is vital for optimum structural and functional properties [1,21]. Also, the pores have to be distributed uniformly in the mass to obtain products of uniform density. Development of larger macropores in the matrix is reported to reduce the density significantly [8]. In conventional terms, the density of aerated concrete is related to its compacity and porosity [3]; while compacity (t) is the ratio of density to the specific weight, the percentage of porosity is $(1 - t) \times 100$.

5. Chemical characteristics

For AAC, X-ray powder diffraction studies have confirmed that the main reaction product belong to tobermorite group of calcium silicate hydrates (C–S–H) [19,22,29,30]. The reaction sequence is: Ca rich C–S–H $\rightarrow$ C–S–H $\rightarrow$ 11.3 Å tobermorite. The reaction product is a mixture of crystalline, semi-crystalline and near amorphous tobermorite, i.e., a material with varying degree of crystallinity, which is defined as the ratio of tobermorites to total calcium silicate hydrates [19]. It is also noted that the only hydrate phase present is calcium silicate. These reaction products have a much lower specific surface than that obtained by moist curing. SEMs show that the microcapillaries in AAC are plate shaped crystals of 11.3 Å tobermorite with a double-chain silicate structure [14], the growth rate and the degree of orientation of which cause differential pore distribution in gas forming and foaming methods [22]. Also they do not show any change with age. The tobermorites show anomalous behaviour, i.e., their basal spacing of 11.3 Å does not shrink to 9.3 Å even at 300°C, as determined by analytical transmission electron microscopy [14,29]. NAAC change their structure from initial needle shaped hydrates to hexagonal ones and then to block shaped calcite crystals, over continued duration of moist-curing [22].

6. Mechanical properties

6.1. Compressive strength

The specimen size and shape, method of pore-formation, direction of loading, age, water content, characteristics of ingredients used and method of curing are reported to influence the strength of aerated concrete [1,8,23,28,30,31]. Pore structure of the air pores and mechanical condition of pore shells have a marked influence on the compressive strength [32]. Density reduction by the formation of large macropores is found to cause a significant strength drop [8]. Generally, compressive strength increases linearly with density. Values of compressive strength for different densities (Table 2) [18] are reported in literature [2,3,18,33,34]. Autoclaving increases the compressive strength significantly, as high temperature and pressure results in a stable form of tobermorite. Final strength is achieved in this case, depending on the pressure and duration of autoclaving. The relationship between autoclaving pressure, duration and compressive strength have been reported for different types of aerated concrete [3]. The strength of NAAC increases 30–80% between 28 days and 6 months, and marginally beyond this period. A portion of this increase is attributed to the process of carbonation [28].

Compressive strength varies inversely with moisture content [35]. On drying to equilibrium with normal atmosphere, there is an increase in strength and an even

Table 2
Properties of AAC aerated concrete [18]

Dry density (kg/m^3)	Compressive strength (MPa)	Static modulus of elasticity (kN/mm^2)	Thermal conductivity (W/m°C)
400	1.3–2.8	0.18–1.17	0.07–0.11
500	2.0–4.4	1.24–1.84	0.08–0.13
600	2.8–6.3	1.76–2.64	0.11–0.17
700	3.9–8.5	2.42–3.58	0.13–0.21

larger increase on complete drying out [36]. Hence tests are recommended on materials that have attained equilibrium with the surroundings. A correction factor has been proposed to assess the increase in compressive strength from wet to dry state [36].

Compressive strength of NAAC and AAC using fly ash as a partial/complete replacement for the filler has proved that the use of fly ash results in a higher strength to density ratio [7,9]. The effect of density on compressive strength of AAC with slate waste has also been reported [10–12].

Strength prediction relations: Several relations have been proposed to assess the compressive strength of aerated concrete.

For foamed concrete, the modified form of Feret's equation [37] relating the strength (S), water–cement (w/c) and air–cement (a/c) ratios, is given as $S = K[1/(1 + (w/c) + (a/c))]^n$, where, K and n are empirical constants. Strength to gel–space ratio relationship for foamed concrete made with proprietary foaming agents were developed by Durack and Weiqing [7].

Porosity is considered to have a significant impact on compressive strength of aerated concrete [38,40]. Some of the strength prediction relations proposed based on porosity are:

(i) *Schiller equation* [38]: $S = K_s \ln(P_{cr}/P)$, P_{cr} is the critical porosity corresponding to zero strength and K_s is a constant.

(ii) *Powers' gel–space ratio* [7,23,39]: $S = Kg^n$, K is the intrinsic strength of the gel and g is the gel–space ratio. The hydrated compound is the *gel* and the filler material along with unhydrated material forms the *space*.

(iii) *Strength–porosity relation in terms of w/c ratio and density for a particular type of cement* [40]: $n = 1 - [d_c(1 + 0.2\rho_c)/(1 + k)\rho_c\gamma_w]^b$, where ρ_c is the specific gravity of cement, γ_w is the unit weight of water, d_c is the concrete density, n is the porosity, k is the water–cement ratio and b is an empirical constant.

(iv) *Balshin expression* [23]: $S = S_0(1 - p)^n$, S_0 is the strength at zero porosity and n is a constant.

While establishing the strength–porosity relationship for AAC with slate waste, a factor called *reciprocal porosity* (V_s/V_p – solid to pore volume ratio) has been coined [12], the relation of which with compressive strength is linear.

6.2. Modulus of elasticity

Most formulae for the modulus of elasticity of AAC in compression report it as a function of the compressive strength [2,3,18,41]. The prediction equations for modulus of elasticity of AAC have been compiled in Table 3.

6.3. Tensile and flexural strength

Valore [2] reports the ratio of direct tensile (T) to compressive strength (S) of AAC to be 0.15–0.35, while Legatski [34] places it at 10–15%. Such variations may be attributed to the fact that the determination of tensile strength is more sensitive to the conditions of the test than that of compressive strength. The ratio of flexural to compressive strength varies from 0.22 to 0.27. For very low density aerated concrete, this value is almost zero [2]. The modulus of rupture of AAC can be roughly estimated according to the formula $\mathrm{MOR} = 0.27 + 0.21 f_{ct}$, where f_{ct} is the compressive strength in MPa [16].

6.4. Drying shrinkage

Drying shrinkage occurs due to the loss of adsorbed water from the material and is significant in aerated concrete because of its high total porosity (40–80%) and specific surface of pores (around 30 m^2/g) [42]. Decrease in pore sizes, along with a higher percentage of pores of smaller size is reported to increase shrinkage. Ziembika [42] has related shrinkage to the volume and specific surface of micropores (pore size of 75–1000 Å) while Schubert [17] attributes it to the distribution of pores. A structural model by Nielson [41] pictures drying shrinkage as a compression due to hydraulic vacuum in the pore water. The capillary tension theory of drying shrinkage of porous building materials states that the water in the pore exists in tension and this creates an attractive force between the pore walls [43].

Table 3
Prediction equations for modulus of elasticity of aerated concrete

Modulus of elasticity	Notations
$6000\ (\alpha)^{1.5}\ S$	α – oven-dry density in g/cm^3, S is the cube compressive strength in kg/cm^2 [2]
$1550\ S^{0.7}$	S is the cube compressive strength in kg/cm^2 [2]
$3000\ S_p$	S_p is the prism strength in kg/cm^2 [3]
$k\ \gamma_{dry}\ (f_c)^{0.5}$	γ_{dry} – dry density in kg/m^3, f_c is the compressive strength in MPa, k is a constant ranging from 1.5 to 2.0 [18]
$c_1\ (\rho - c_2)$	c_1 and c_2 – constants, ρ – dry density in kg/m^3, E is in MPa [41]

Drying shrinkage of aerated concrete with only cement as the binder is reported to be significantly higher than that produced with lime or lime and cement. The shrinkage of lime–cement products is the least. With an increasing amount of reactive silica in the paste, shrinkage increases and attains a maximum value at 30–60% silica replacement and then decreases [44]. The duration and method of curing, pressure of autoclaving, fineness and chemical composition of silica, additives like fly ash, the size and shape of the specimen and the time and climate of storage affect the drying shrinkage [17,42,44–46]. Additives like superplasticiser and silica fume were found to have little effect on shrinkage, confirming that the drying shrinkage of aerated concrete is dependent on the physical structure of the gel rather than on its chemical composition [23].

Air-cured specimen have very high drying shrinkage. Moist-cured cement–sand mixes show drying shrinkage values ranging from 0.06 to over 3% when dried at ordinary temperatures, the lower values being associated with higher densities and higher percentages of sand [2]. Tada and Nakano [22] attribute the higher shrinkage in NAAC to its larger volume of finer pores. However, when the same product is autoclaved, fundamental changes take place in the mineral constitution, which may reduce shrinkage to one-quarter or even one-fifth of that of air-cured product. This is because of the formation of well-crystallised tobermorite in AAC products. The gel form of set cement, as is the case in air-cured products, is converted to a microcrystalline form by autoclaving. Alexanderson [19] reports that the crystallinity has a decisive influence on both strength and shrinkage, i.e., with increasing crystallinity, shrinkage reduces and compressive strength increases to an optimum value and then decreases. Shrinkage is increased when porosity is decreased; this is explained by the fact that crystallinity is also decreased [17]. The maximum level of shrinkage is dependent on the development of CSH (I) and the minimum level on the conversion of CSH (I) into tobermorite [17]. Georgiades and Ftikos [46] have reported that the drying shrinkage of AAC is a function of volume and specific surface of micropores with radii 20–200 Å. Final shrinkage of AAC is almost independent of the dry density [16].

The time dependence of shrinkage is influenced by material properties, size of specimen and shrinkage climate. This apart, the final value of shrinkage depends on the initial and final moisture content. The drying shrinkage, in most cases, increases if the relative humidity decreases. In the range of higher moisture content (greater than 20% by volume), a relatively small shrinkage occurs with loss of moisture, which can be attributed to the presence of more number of large pores which do not contribute to shrinkage [17].

7. Functional properties

7.1. Water absorption and capillarity

Aerated concrete being porous, there is a strong interaction between water, water vapour and the porous system and there exists various moisture transport mechanisms. In the dry state, pores are empty and the water vapour diffusion dominates, while some pores are filled in higher humidity regions. Capillary suction predominates for an element in contact with water. These mechanisms make it difficult to predict the influence of pore size distribution and water content on moisture migration [21].

The water vapour transfer is explained in terms of water vapour permeability and moisture diffusion coefficient whereas capillary suction [47] and water permeability characterise the water transfer [21,43]. The moisture transport phenomena in porous materials, by absorbing and transmitting water by capillarity, has been defined by an easily measurable property called the sorptivity, which is based on unsaturated flow theory [48,49]. It has been shown that the water transmission property is better explained by sorptivity than by permeability. The concept of capillary hygroscopicity [3] also employs the same principle as sorption. These values give a fair indication of the fineness of the pores.

7.2. Durability

AAC mainly consists of tobermorite, which is much more stable than the products formed in normally cured aerated concrete, and hence it is durable. However, aerated concrete has high porosity, allowing penetration by liquids and gases. This may lead to the damage of the matrix [16]. Freeze-thaw reactions are reported to be significant as far as AAC is concerned at saturation degrees of 20–40%. At higher degrees of saturation, the sample becomes brittle and cracks completely [50]. Protective precautions using bitumen-based materials are necessary when sulphate attack is anticipated. Carbonation can lead to increase in density but it is not very serious unless the exposure to CO_2 is too severe [18].

7.3. Thermal conductivity

Thermal conductivity depends on density, moisture content and ingredients of the material [3,10,51–54]. As thermal conductivity is largely a function of density, it does not really matter whether the product is moist cured or autoclaved as far as thermal conductivity is concerned. The amount of pores and their distribution are also critical for thermal insulation [55]. Finer the pores better the insulation. As the thermal conductivity is influenced by the moisture content [53] (a 1% increase in moisture by mass increases thermal conductivity by 42% [16]), it should not be reported in oven dry condition. Based on the thermal performance requirements for buildings, an optimum material design has been proposed by Tada [56].

7.4. Fire resistance

In practice, the fire-resistance of aerated concrete is more than or as good as ordinary dense concrete [2,3] and hence its use does not involve any risk of spread of flames. An important reason for such behaviour is that the material is relatively homogeneous, unlike normal concrete where the presence of coarse aggregate leads to differential rates of expansion, cracking and disintegration [57]. The good fire resisting property of aerated concrete is where its closed pore structure pays rich dividends, as heat transfer through radiation is an inverse function of the number of air–solid interfaces traversed. This coupled with their low thermal conductivity and diffusivity gives an indication that aerated concrete possesses better fire-resisting properties.

7.5. Acoustical properties

Valore [2] states that aerated concrete does not possess unique or significant sound insulation characteristics. The reason stated is that transmission loss (TL) of air-borne sound is dependent on the mass law, which is a function of frequency and surface density of the component. Tada attributes the TL to the rigidity and internal resistance of the wall, in addition to the mass law and gives an acoustical performance design of aerated concrete based on bulk density and thickness [56]. Leitch argues that the sound insulation, like thermal and fire insulation, is affected by the closed porous structure [57].

8. Summary

Summarising the research pertaining to the structure and properties of aerated concrete, the salient observations are: (i) the method of pore-formation and curing plays a significant role in its microstructure and properties; (ii) the properties are influenced by the density and thus, they should be qualified with the density, which is to be specified along with the moisture content; (iii) the chemical composition varies with the method of curing – tobermorite gel being formed for moist-cured products and a more stable form of tobermorite on autoclaving; (iv) strength of AAC is significantly higher due to the above reason; (v) strength – porosity relationships have been developed for aerated concrete based on concept of gel–space ratio and Balshin's expression; (vi) the drying shrinkage of AAC is lower; they range from one-fourth to one-fifth of that of NAAC. The material properties and shrinkage climate also influences drying shrinkage; (vii) aerated concrete exhibits good functional performance characteristics.

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