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# COMPOSITION ON THE BASIS OF FLUORINEANHYDRITE AND EXPANDED POLYSTYRENE FOR THE THERMAL PROTECTION

Technogenic anhydrite is a withdrawal of manufacture of fluoric acid. At activation by known chemical compounds it is capable to show binding properties. It can be applied in polystyrene concrete in the form of a binding matrix. For formation of strong contacts it is necessary to create the thin films providing good adhesion polystyrene of granules to the binding matrix. For this purpose used pitch wood soaped (SDO). In work the parity between density polystyrene of concrete and necessary durability at design age was optimized.

**Keywords:** technogenic anhydrite, polystyrene concrete, contacts, binding matrix.

## 1 Introduction

Technogenic anhydrite is a withdrawal of manufacture of fluoric acid from fluorite by means of processing by its sulfuric acid. At activation by known chemical compounds it is capable to show binding properties [1]. Application fluorine of anhydrite as knitting for preparation of easy concrete [2] allows to reduce cost of products several times for the absence account components of cement as a part of a material and to simplify "the know-how".

At designing and building of buildings the question of decrease in weight of separate designs and all building as a whole [3] is actual. In designs of buildings safe, building materials small the power consumption, made on technologies on the basis of primary use of products of processing of a technogenic waste and a local natural source of raw materials [4, 5] should be applied. Applied to a thermal protection of building designs of a plate from polystyrene provide necessary properties, but during too time they have the lacks limiting their wide use, such as low durability, the combustibility, insufficient durability in it of the chemical bonds, causing its chemical destruction while in service. These lacks substantially can be lowered or eliminated, using expanded polystyrene in kind granules as filler in the easy concrete known on works [6, 7] and matrix without cement.

Thus, working out of easy concrete on the basis of a matrix from anhydrite with application polystyrene porous granules is one of priority directions who allows to solve simultaneously problems of ecology and to receive "know-how" effective the materials, saving up energy.

**2 Text**

Used fluorine anhydrite - a withdrawal of manufacture of fluoric acid in the form of a powder, contains in the structure more than 92 % $CaSO_4$. It was exposed to a grinding to a specific surface of 2800 $sm^2/g$ [8].

For preparation a composite material for a thermal protection as easy filler spherical porous granules of polystyrene with a size from 2 to 5 mm and density 15 $kg/m^3$ were used.

As the reinforcing additive in structure of a developed composite it was added a basalt fibre in length 10 - 12 mm and average diameter 4,5 microns. The initial basalt fibre consists of fibres in length 70 - 120 mm. Basalt fibres possess high durability and chemical firmness in the alkaline environment which prevails in structure composite of anhydrite.

The basic problem of reception qualitative concrete polystyrene on anhydrite to a binding matrix is parity optimization between its density and necessary durability at design age. One of conditions of formation of stronger contacts in the given system is creation of intermediate layers from the thin films providing good adhesion [9, 10] of granules to the binding matrix by means of application of surface-active additives.

At carrying out of experiments as such additive pitch wood soaped (SDO) [11] in number of 0,3 % was used. Besides, SDO represents itself as the additive which involves air and raises formation, promoting improvement of formation of a mix and increase of porosity of a matrix from anhydrite – see Figure 1a.

**a)** **b)** **c)**

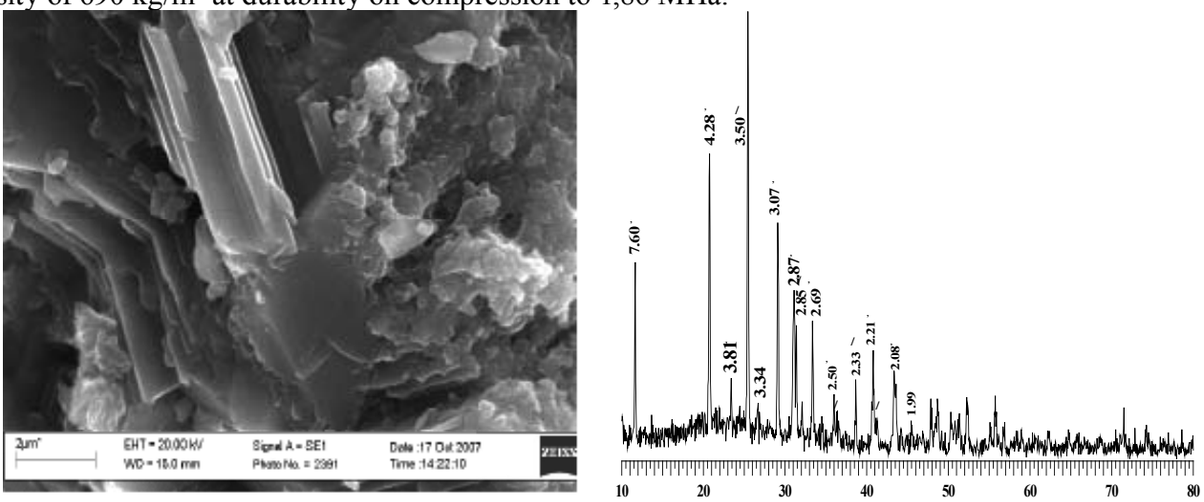
**Figure 1**. Structure concrete polystyrene - (a), structure of a matrix from anhydrite - (b), character of coupling of a matrix from fluorine anhydrite with a basalt fibre - (c) at 200-fold increase

Additional porosity of a matrix from anhydrite as a part of a concrete mix with polystyrene is reached at the expense of chemical interaction of the activator of solidification with components fluorine anhydrite, providing upwarp matrixes from anhydrite – see Figure 1b. Decrease in average density, increase steam - both gas proofness and improvement of adhesion of an organic filler with a mineral matrix is thus marked. Studying of a microstructure of concrete on binder of anhydrite with polystyrene on polarising microscope МИН-8 has shown that its microstructure is characterised by good adhesion of a matrix from anhydrite to granules from polystyrene and to a basalt fibre – see Figure 1в. The analysis of a microstructure by means of raster electronic microscope EVO 50 of ZEISS has shown presence in a matrix from anhydrite of crystal new growths of traditional structure with lamellar plaster and presence of an amorphous phase – see Figure 2a. Presence dehydrate proves to be true X-ray research of concrete on the basis of anhydrite – see Figure 2b.

In a matrix along with reflexions $CaSO_4$ ($d_a$, Å = 3.50; 2.85; 2.33) there are strong reflexions, $CaSO_4 \cdot 2H_2O$ ($d_a$, Å = 7.60; 4.28; 3.07; 2.87; 2.69; 2.21).

Mechanical tests of samples with the sizes 100x100x100 mm have shown achievement of average

density of 690 kg/m$^3$ at durability on compression to 1,86 МПа.




a) b)

**Figure 2.** Microstructure of a matrix from anhydrite - (a),
X-ray research of a matrix from anhydrite in polystyrene concrete - (b)

Absorption of water by polystyrene concrete thus did not exceed 8 %, the emolliating coefficient has made 0,68. The analysis of a hydrogen exponent of medium in polystyrene concrete intermixture has shown quantity pH ›11 that predetermines possibility of use for reinforcing of steel armature in polystyrene concrete.

Considering that each granule of polystyrene is coated by a matrix from anhydrite, it is necessary to expect lack chemical fracture some polystyrene in the course of the long-term operation of concrete and pinch of its fire safety owing to allocation dehydrate thermal action of steams of water.

The gained easy concrete has density D700, possesses good steam - and gas permeability, is fireproof, prevents fracture polystyrene at operation and has sufficient strength for preparation of products in the form of plates for a heat insulation and blocks.

**3 Conclusion**

Thus, use of anhydrite as a knitting matrix in polystyrene concrete allows to lower essentially cost of a received material at the expense of an exception expensive cement from structure of a composite and to improve conditions in the locations of sailings.

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**КОМПОЗИЦИЯ НА ОСНОВЕ ФТОРОАНГИДРИТА И ПЕНОПОЛИСТИРОЛА ДЛЯ ТЕПЛОВОЙ ЗАЩИТЫ**

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Техногенный ангидрит является отходом производства плавиковой кислоты. При активации с помощью известных химических соединений, он способен проявлять вяжущие свойства. Он может быть применен в полистиролбетоне в качестве связующей матрицы. Для формирования сильного контакта необходимо создать тонкие пленки, обеспечивая хорошую адгезию полистирольных гранул в матрице вяжущего. Для этого используется смола древесная омыленная (СДО). В работе было оптимизировано соотношение между плотностью полистиролбетона и необходимой прочностью в проектном возрасте.

**Ключевые слова:** техногенный ангидрит, полистиролбетон, контакты, связующая матрица.

**КОМПОЗИЦІЯ НА ОСНОВІ ФТОРОАНГІДРИТУ І ПІНОПОЛІСТИРОЛУ ДЛЯ ТЕПЛОВОГО ЗАХИСТУ**

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Техногенний ангідрит є відходом виробництва плавикової кислоти. При активації за допомогою відомих хімічних сполук, він здатний проявляти в'яжучі властивості. Він може бути застосований в полістиролбетоні в якості в'яжучої матриці. Для формування сильного контакту необхідно створити тонкі плівки, забезпечуючи хорошу адгезію полістирольних гранул в матриці в'яжучого. Для цього використовується смола деревна омилена (СДО). У роботі було оптимізовано співвідношення між густиною полістиролбетону і необхідною міцністю в проектному віці.

**Ключові слова:** техногенний ангідрит, полістиролбетон, контакти, зв'язуюча матриця.