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Preface

Development of the material-technological base in the field of construction is progressing faster than in the previous periods. Based on the potential of new materials and technologies, it is possible to create advanced engineering building systems. Integration of advanced materials, technologies and construction systems creates a high-quality construction with optimum performance in the presence as well as in the future. Nevertheless, improper application of high quality materials in the wrong environment may cause a defect.

Research in the field of building materials, technologies and construction is currently primarily driven by energy efficiency, ecology and quality of the human environment. The importance of energy efficiency is affected secondarily by limited resources of fossil fuels. Another significant moment in this part is the price of energy and forecasts of its growth. Ecology of environment enters the problem through the external environment and ecology of artificially produced human environment. An important factor in terms of ecology is a comprehensive view of the construction work and its segments in the context of the production of pollution produced in the manufacture, transport, installation, exploitation and recycling or removal (rated as for example: primary energy of the material). Construction is currently focusing on higher energy standards using environmentally friendly materials and energy based on renewable resources. The quality of the internal environment has a direct impact on the users, on their health, abilities, well-being and safety.

Saving energy and increasing energy standard applied to buildings entails numerous problems related to energy and economic efficiency, thermal and technical features of building materials and construction, built-in moisture with operational moisture regime, indoor air quality connected with aerodynamic characteristics of the construction. By using a high-performance insulation, which is often flammable, fire safety problems may arise. By changing the scope and material-design solutions form different acoustic parameters of the works. Energy optimization of proportionality, transparent and non-transparent container structures housing brings light and technical problems.

For solutions to these issues is important choosing the right methodology solutions whether in the form of experimental verification, surveillance or computer modeling.

The aim of this international conference is to inform the general public with the results derived from research and practices related to the above-mentioned issues.

Topics:
- Degradation of Building Materials
- Energy Saving and Ecological Buildings
- Thermal Performance of Building Materials and Constructions
- Aerodynamic Characteristics of Buildings and Construction
- Indoor Air Quality and Air Exchange
- Fire Safety Materials, Spaces and Construction
- Noise Protection
- Daylight Conditions

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CHAPTER 1:

Degradation of Building Materials

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Degradation of PVC-P membranes in flat roof compositions

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Keywords: Incompatibility, degradation, PVC-P membrane, EPS polystyrene, bitumen, plasticizer.

Abstract. The degradation of PVC-P membranes in direct contact with bituminous membranes is well known problem. There is also the degradation of PVC-P membranes connected with EPS polystyrene incompatibility. Both bituminous membranes and EPS polystyrene board have been used to determine the differences in signs of PVC-P degradation.

Introduction

The roof structure consists of several functional layers and their primary function imposes requirements on their material base. Therefore, it is difficult to avoid the combination of different base materials. If you underestimate mutual incompatibility, then either there are used the high quality materials, it does not necessarily mean long-term reliability and durability of flat roof.

Degradation of building materials can occur by external factors (weather conditions), the actions of internal influences and also by the action of other building materials (direct contact of incompatible materials). The result is that the two materials which are seen as stable and resistant materials will behave unstable and prone to unexpected loss of declared properties.

Goals of this study

The goals of this study were to obtain the information about the degradation process and compare the signs of degradation of PVC-P membrane caused by different type of surrounding medium. Incompatible surrounding medium, in this case means a building material, which is integrated in the constructions together with PVC-P waterproof membrane. There were considered two types of incompatible materials. First of incompatible medium is used EPS polystyrene, which represents thermal insulation in flat roof composition. Second incompatible medium is oxidized bitumen, which represents the top waterproof layer of old flat roof.

Materials and combinations

Samples of PVC-P membranes were stored in the laboratory oven at a constant temperature of 60 °C for 90 and 180 days. The combination Z.1 consists of PVC-P membrane without direct contact with incompatible materials. Z.2.1 consists of PVC-P membrane in direct contact with incompatible material (EPS polystyrene). Z.2.2 consists of PVC-P membrane in combination with polyester 300g/m^2 geotextile separation layer interposed between the investigated materials (EPS polystyrene and PVC-P membrane). Z.2.3 is combination of PVC-P, EPS and polyester 300g/m^2 geotextile separation layer, which is inserted between the studied materials and is saturated with water, which represented the state of leaking into the roof deck. Z.3.1 is a combination of PVC-P and oxidized bitumen in their direct contact. Z.3.2 consists of PVC-P membrane in combination with polyester 300g/m^2 geotextile separation layer interposed between the investigated materials (oxidized bitumen and PVC-P membrane). Z.2.3 is a combination of PVC-P, oxidized bitumen and polyester 300g/m^2 geotextile separation layer, which is inserted between the studied materials and is saturated with water, which represented the state of leaking into the roof deck.

Results

After completing the cycle of artificial thermal aging were combinations pulled out from a hot air oven and the visual inspection was carried out. .We observed no significant changes on the surface of PVC-P in all configurations Z.2.1 to Z.2.3 at 90 and 180 days cycles. Migratory platicizers from PVC-P to EPS combined both materials and create a sticky shiny layer on the surface of the EPS specimen. The PVC-P membrane was stiffer than before. It was observed the loss in thickness of EPS in direct contact with the PVC-P. In other combinations Z.2.2 and Z.2.3 were no significant and visible changes observed (Fig. 1).

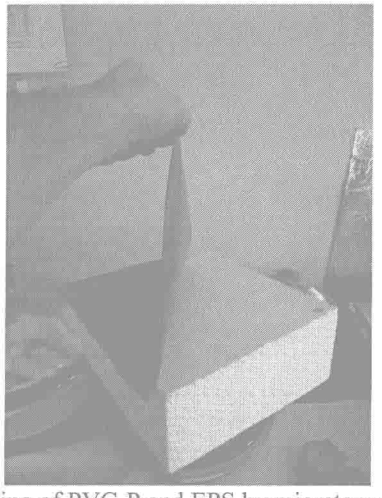

Fig. 1 Bonding of PVC-P and EPS by migratory plasticizers

By visual inspection we observed creation of locally degraded place on the surface of PVC-P when there was direct contact PVC-P with oxidized bitumen in combinations Z.3.1. Places were colored and stiffer. After 90 days at 60 °C are locally degraded places a maximum size of 30 mm in diameter. In this point was certainly a significant loss of plasticizers from PVC-P. The mass of oxidized bitumen, which is attacked by migrating plasticizers, is modified in those places and is softer (Fig. 2).

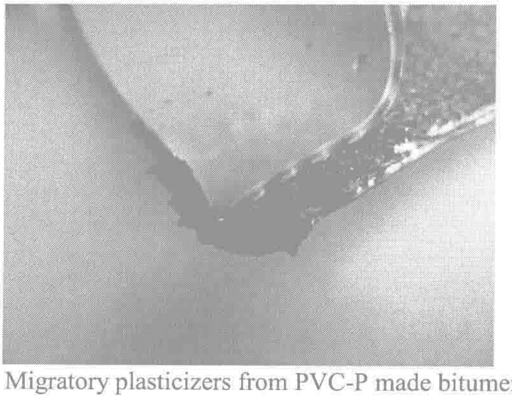

Fig. 2 Migratory plasticizers from PVC-P made bitumen softer

All samples were subjected to a process of weighing before and after the end of exposure in the hot air oven. Samples of PVC-P membrane exhibited a weight loss of 0,09 to 4,79 % depending on the combination with the surrounding medium and exposure time. The loss in weight is mainly represented by loss of volatile materials. Plasticizers migration caused increasing in weight of the samples and also changes in thickness of EPS. Migratory plasticizers from PVC-P to EPS caused loss in thickness of EPS. It is 4,82 mm after 3-months exposure at 60 °C. After 6-months exposure it was observed decrease in thickness of 6,52 mm.

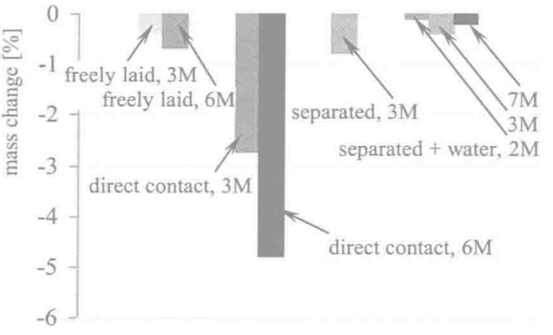

Fig. 3 Mass change comparison of PVC and EPS specimens

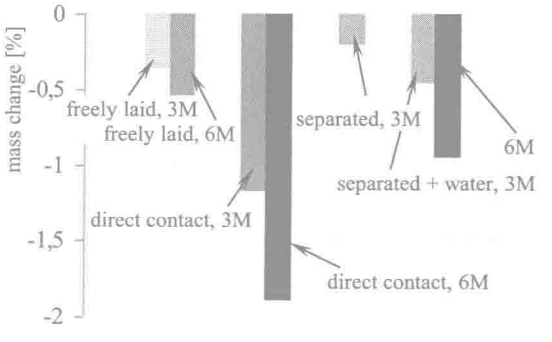

Fig. 4 Mass change comparison of PVC and oxidized asphalt specimens

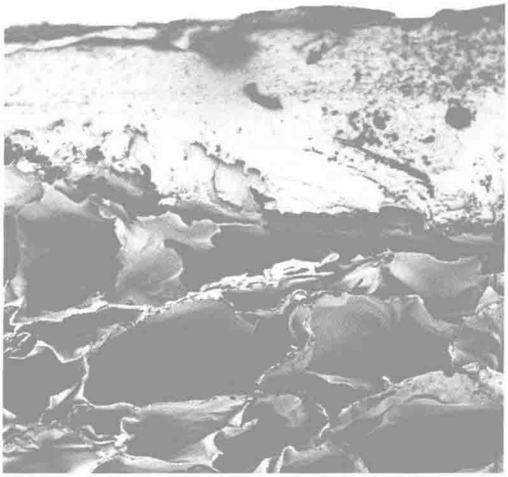

Fig. 5 Melted glassy layer on the top of EPS polystyrene

Conclusion

The results from laboratory measurements of PVC-P membranes in the combinations with EPS and oxidized bitumen indicate that degradation of PVC-P membrane in connected with material incompatibility of those materials. The degradation of PVC-P is represented by the loss of plasticizers. Both evaporation and migration of plasticizers were observed. The direct contact of PVC-P membrane and EPS also caused degradation of EPS insulation board. The direct contact of PVC-P and oxidized bitumen leads to degradations of both materials. The presence of the separating layer between two incompatible materials PVC-P and EPS, PVC-P and oxidized bitumen reduces the extent of degradation, but the presence of moisture in the separation layer reduces the efficiency of the separation layer. The main difference in behavior of degradations when there is moisture in separation layer is that there is softening of PVC-P in contact with EPS and hardening of PVC-P in contact with oxidized bitumen.

The results indicate that the materials such as EPS and oxidized bitumen have an impact on the degradation of PVC-P. The observed signs of degradation are not the same for all fault roofs. Discover knowledge in laboratory conditions can not be taken as a rule with the exact course of degradation. It is necessary to take into account the impact of the particular composition of PVC-P, quality of materials and used plasticizers.

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PROGRESSIVE WAYS OF THE WATERPROOFING OF BUILDINGS

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Keywords: waterproofing, building, moisture, water, pressure, bentonite

Abstract

The article deals with the newly developed damp proofing systems. They are aimed at principles of the design of constructional details of substructures resisting water and ground dampness with application of the latest materials, technology and constructional design of damp proofing system layers and details.

Foreword

Water is of vital importance to human beings. On the other hand the water presents great danger to structures, mainly the subterranean constructions.

Damp proofing of a substructure includes mainly damp proofing of wall structures situated under the level of the terrain and horizontal proofing of floor constructions located directly on the terrain or on the foundation construction.

Damp proofing of subterranean parts of constructions does not often meet the requirements on the efficiency of damp proofing particularly under the conditions of gravitational precipitation or underground water. The importance of such damp proofing is often under evaluated at the phase of the design. Construction is often performed by
workers who have inadequate qualifications and professional practice. Protection of subterranean construction against dampness and underground water requires design of such materials and constructional methods which have to withstand dampness and water with a long lasting affect and at the same time meets all the other requirements on the detail and the structure as a whole.

Damp Proofing Created by the Construction Made of Water-Resistant Concrete

The term water-resistance of concrete applies both to watertight and durable concrete. It is used for constructions which in addition to water tightness require high durability of concrete (frost-resistance, can resist aggressive actions etc.).

In accordance with the 73 1210 Standard (STN) the water-resistant concrete applies to the concrete which withstands the water pressure so that no visible seepage occurs outside of the applied water pressure. Only a small amount of water penetrates the walls through the outside of the applied water and this depends on different parameters (approximately1 g/m^2 a day).

The quality of watertight concrete can only be provided by the observance of technical parameters which are dependent on the choice of components and the design of concrete composition with regard to the required properties of concrete.

In order to manufacture watertight concrete the kind of concrete is chosen in dependence what effects of media will act on a particular concrete construction. In addition, the fact whether the construction is a thin-walled structure or a solid structure The quality of watertight concrete can only be provided by the observance of technical parameters which are dependent on the choice of components and the design of concrete composition with regard to the required properties of concrete.

In order to manufacture watertight concrete the kind of concrete is chosen in dependence what effects of media will act on a particular concrete construction. In addition, the fact whether the construction is a thin-walled structure or a solid structure must be respected. The STN 73 121 specifies the types of cement. It is not permitted to use CEM I, CEM II/A-S and CEM II/B-S with a higher strength class than 32.5.

It is common to use cements with a low heat of hydration according to STN EN 197-1/A1 for concrete placing of solid structures. The amount of cement also depends on the thickness of the structure (the amount of concrete should not exceed more than 400kg/m^3 for structures up to the max. thickness of 600 mm and 320 kg/m^3 for structures with larger thickness.

The next component of watertight concrete is the dense aggregate which must fulfill the requirements of STN EN 12620. The maximum aggregate size D_{max} is usually up to 32 mm. It is recommended to use D_{max} = 16 mm for thin reinforced structures. It is also significant to emphasize the importance of admissible aggregate grading and tolerable shape of grains. There must be sufficient but not an exceeding number of particles smaller than 0.25 mm contained in aggregates for good workability of fresh concrete and impermeability of hardened concrete. In case of their deficiency it is recommended to add more mineral admixtures than to increase the amount of concrete (higher heat of hydration, shrinkage).

In case of watertight concrete permeability has a decisive effect on its performance. The microstructure of cement matrix and the interfacial transitional zone between the cement matrix and the surface of aggregate grains decides on the water tightness of concrete.

In order to provide the water tightness of concrete it is advisable to decrease the content of capillary pores. A smaller amount of mixing water in the concrete is a significant technological procedure in this case. Max. water-to-cement ratio for watertight concrete is recommended for the above reason.

The watertight concrete consistency is selected in dependence on the type of a structure and conditions of concrete processing. The limited value of the water-to-cement ratio determines the application of water reducing admixtures in order to achieve the required consistency.

The water tightness of concrete itself as a material does not guarantee that the construction made of it will also be watertight. Cracks, dilatation and construction joints must not occur in hardened concrete. Therefore construction must be designed and watertight accordingly.

Great attention has to be paid to following the technological phases during the concrete processing and consequently to concrete curing above all.

Currently, watertight concrete is used for the construction of water-tight tanks where concrete parts have both the bearing and water proofing functions.

The construction joint, which we cannot avoid, occurs in case of reinforced concrete slab and vertical wall. Consequently, it has to be sealed in the same way as in the case of large structures where additional dilatation and constructional joints occur in reinforced concrete slabs or vertical walls (Fig.1 and Fig.2).

In Fig.1 we can see the construction joint between the reinforced concrete slab and the vertical watertight concrete wall interconnected with the inner sealing strip and in Fig.2 we can see the construction and dilatation joints interconnected with the sealing and dilatation strips placed inside of the foundation reinforced concrete slab.

Damp Proofing by the Bentonite Mat

Recently, bentonite mats for waterproof sealing have gained greater importance. The double bentonite waterproofing mat (CEMtobent-CS) commonly called as "the brown tank" was specially developed for this purpose in order to waterproof structures.