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Are Mineral Toppings of Asphalt Roofing Sufficient to Protect Flat Roofs and Roofing Felt Alone?

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1 Exordium

Mineral surfaces are an integral part of bituminous roofing felt. Their task is to protect less resistant elements from the destructive effects of the environment. Since the first application in 1897, they have been constantly improved in the direction of better functionality and aesthetics. It often turns out that the intended effect has not been achieved. During the first years of operation, there are signs of roof damage on most facilities.

Figure 1. This is a comparison of topping on new roofing paper and topping on the same roofing paper after several years of use in adverse conditions (on the right photo a drastic example of a significant loss of granules and exposure of asphalt in a roof depression - a periodic puddle).

Due to the complex interaction of roofing elements, several causes of damage can be defined. A group of processes taking place in mineral roofing toppings is important for roofing felt. Mineral surfaces are exposed to physical, chemical and biological factors. They cause losses due to the unavoidable breaking of adhesion to the modified asphalt. Pulling out caused by factors occurring on the roof is a long-term process with more effects on the covering, in particular its durability and tightness.

As a result of research and analysis, we have determined that the number of positive impacts for the roof is smaller than the negative ones.

Positive impacts of roofing toppings include: mechanical protection, UV protection, enabling, by means of adhesion, the use of additional roofing protection (*e.g.* expensive paints increasing the reflection of heat radiation); architectural and decorative function.

Negative impacts of roof granules - the "protective layer" for the roofs are: uncertainty of attachment in polymer-asphalt and protection losses; too high porosity of the layer and the possibility of retaining deposits and water in the layer; systematic and unavoidable release of granule during roof operation; leaching of sulfur compounds from asphalt resulting from

the method of releasing the granules (pulling out, UV exposure, slow destruction of the surface); too much heat radiation absorption; possibility of mechanical destructive impact on polymer-asphalt; making it possible to transfer the destructive effects of freezing water to polymer-asphalt (the protective layer is a tool of destruction); accumulation of released pellets in different areas of the roof increasing the amount of deposits and water retained on the roof; mechanical impact of granules transported by rain and wind on other roof elements; participation in clogging water outflows; weakening of torched joints between the ends of the roofing felt.

The list of negatives of the roofing topping occurrence on the roof is definitely longer. Encountering these bad influences every day we react by adding new additions and corrections to the existing solution. Thanks to many years of observation of the condition of flat roofs and counteracting the problems, we can draw conclusions and propose solutions.

Elimination the negative effects of roof granules on existing roofing felt is possible by: coating with materials that reduce the porosity of the layer; covering with materials increasing the reflection of solar radiation; increasing resistance to the development of living organisms; coating with materials that reduce the release of primarily sulfur compounds. Such actions are effective but expensive and labor-intensive. It's time to reinvent roofing felt again and to apply on them the solutions without the defects indicated, allowing significant extension of its safe and cheaper usage.

According to the authors of the study, such deliberate actions are aimed to eliminate the negative effects of granules layer by replacing its in the production process with materials characterized by: inability to accumulate in the layer wet and dry deposits; reflection of a significant part of solar radiation; limiting or eliminating the possibility of harmful chemical compounds emission from modified asphalt, above all sulfur ; high adhesion to asphalt; the possibility of periodic and cheap renovation - enabling the use of cheap spray paints; enabling the effects of texture and colors for small roofs; gives possibility of obtain flat and smooth self-cleaning surfaces for large-area roofs. Such actions are more beneficial, cost effective and introduce the possibility of cheaper and simpler systematic renovation of roof coverings, increasing their durability.

An additional problem that needs to be addressed in relation to climate change is the urgent need to redefine the territorial use of cover materials and their required characteristics for these areas.

We would also like to inform that the authors team is in the process of developing and patenting a new material solution for the surface layer of asphalt felt for flat roofs. The solution should, basing on existing production technology, enable the production of a new generation of roofing felt.

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