Resin coating concept with less environmental impact

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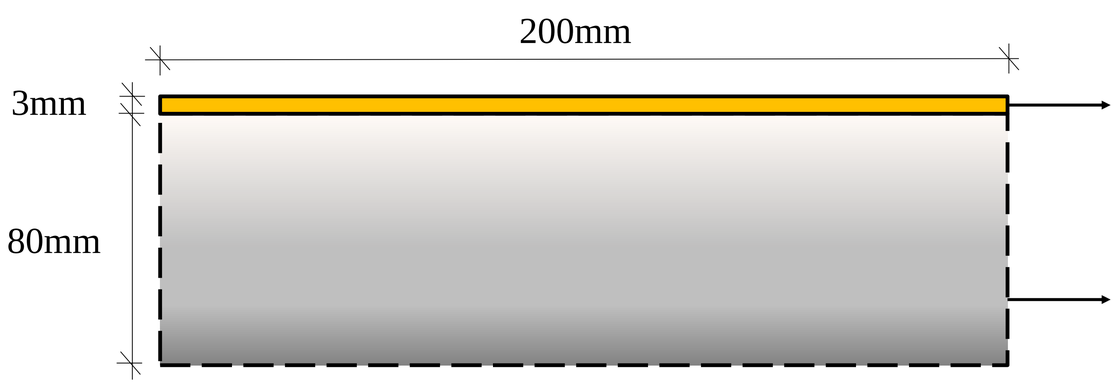
Introduction

Due to the ever-increasing prices of building materials, many investors are looking for savings. At the same time, the issue of their impact on the environment is also not indifferent to them. Recently, there has been an increase in publications on the use of waste or natural materials in construction products such as concrete or resin. Materials such as recycled aggregate [1], natural fibers [2] or granite powder [3] also added to the resin were used.
In the described test, the base layer of the epoxy coating was modified with granite powder in the amount of 0% to 50% (variable every 10%) in relation to the mass of resin and linen fibers in the amount of 0 to 1.5% (variable every 0.5%) in relation to the mass of resin . A reference sample was also made to compare the obtained results. The pull-off strength of the epoxy resin coating was tested for each configuration and the results were compared to a reference sample. The highest pull-off strength of the coating was observed for the substrate with the addition of 30% granite powder and 1.5% linen fibers (increase by 17.5% compared to the reference sample). In addition, a significant reduction in the cost of coating was observed.

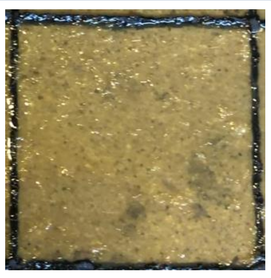
Description of the study



The test was performed on a C25/30 concrete base. After its hardening, the surface was sanded and degreased, and then 24 research fields were separated. The resin used consisted of two components: A and B. After measuring the first component, the measured amount of linen fibers was added and the content was mixed. In the next step, the appropriate amount of granite powder was added. After mixing, component B was added and mixed again. The modified resin was then applied to the substrate to obtain a layer 3 mm thick.

The study examined the effect of adding 0%, 10%, 20%, 30%, 40% and 50% of granite powder and 0%, 0.5%, 1.0% and 1.5% of linen fibers to the epoxy resin layer.

Results



Resin-flooded sample

Drilling holes for discs

Sticking discs

Adhesion test

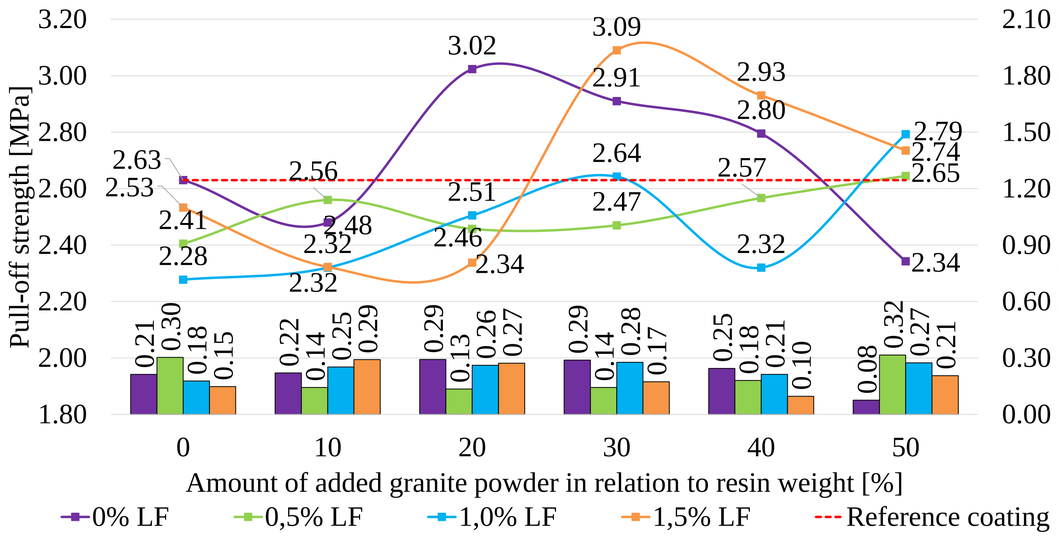


Fig. 1. The dependence of the strength on the amount of granite powder and linen fibers added

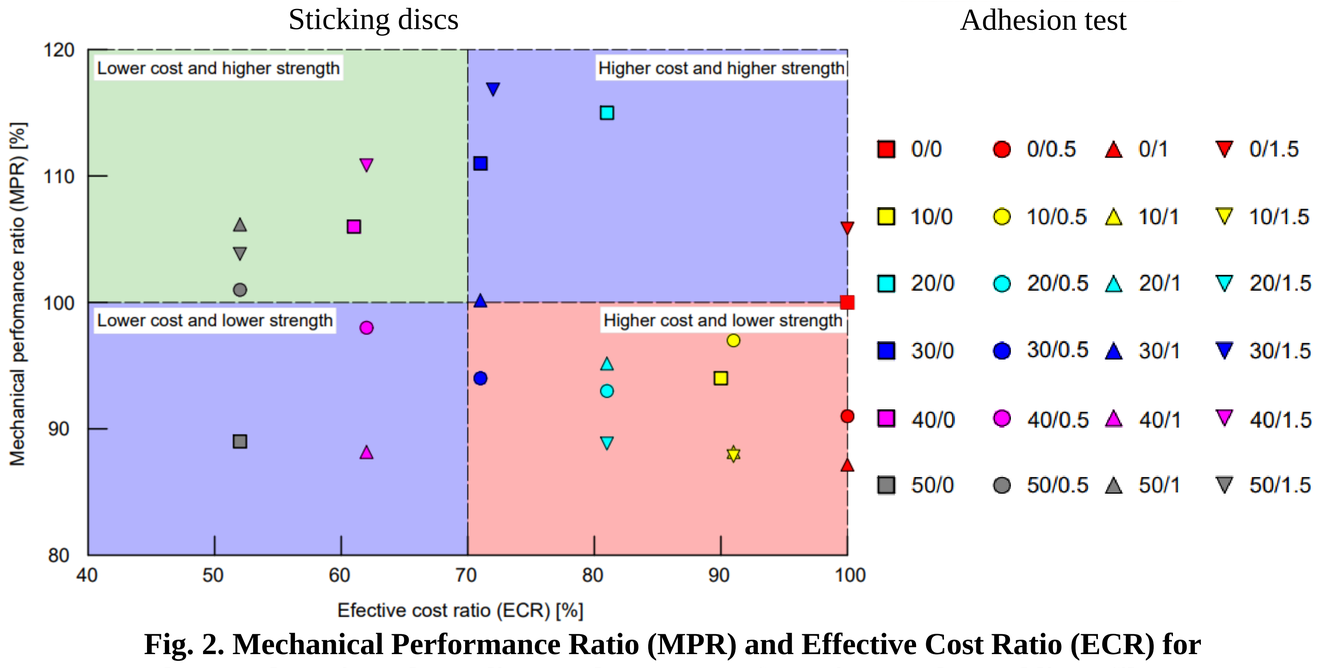


Fig. 2. Mechanical Performance Ratio (MPR) and Effective Cost Ratio (ECR) for the tested coatings depending on the amount of granite powder and linen fibers.

Conclusions

The increase in strength was found in 9 coatings, and the highest value was 3.09 MPa (σ = 0.17 MPa), which is 0.46 MPa (17.5%) better than the reference coating. This value was obtained with the addition of 1.5% of linen fibers and 30% of granite powder. A similar result was obtained after adding 0% fibers and 20% powder. Figure 2 shows the relationship Mechanical Performance Ratio (MPR) and Effective Cost Ratio (ECR) for the tested coatings depending on the amount of powder and fibers. It shows that the addition of powder significantly reduces the cost of the coating. Each percentage of powder added reduces the crafting cost by 1%. Adding fibers does not change the cost. This shows how easy it is to reduce the cost of the coating while increasing the pull-off strength.

References

[1] K. Krzywiński, Ł. Sadowski, D. Stefaniuk, A. Obrosov, S. Weiß, pp. 253-271, (2022)
[2] Ł. Sadowski, Ł. Kampa, A. Chowaniec, A. Królicka, A. Żak, H. Abdoulpour, S. Vantadori, pp. 124078, (2021)
[3] Ł. Kampa, A. Chowaniec, A. Królicka, Ł. Sadowski, pp. 1303-1316, (2022)