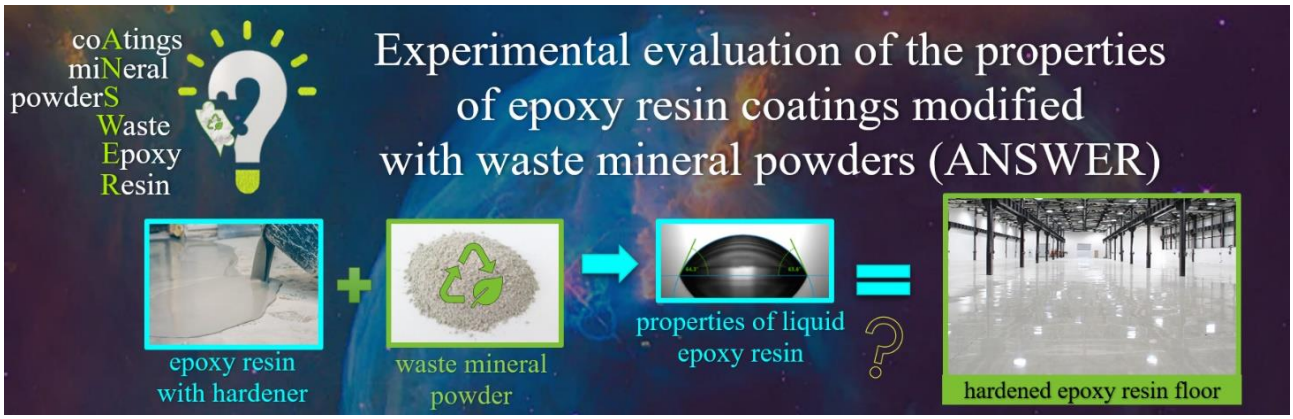
coAtings
miNeral
powderS
Waste
Epoxy
Resin

Experimental evaluation of the properties of epoxy resin coatings modified with waste mineral powders (ANSWER)

Epoxy resins are used in civil engineering as coatings in industrial floors. The most important properties of the epoxy resins are the density, viscosity, contact angle, hardness, impact resistance, compressive, tensile and flexural strength, glass transition temperature and pull-off strength. Especially for liquid epoxy resins at mixing and application stages the viscosity and the contact angle are the key factor. The another important step is to achieve satisfying properties of the hardened resins. Thus, the hardness, impact resistance, compressive, tensile and flexural strength are also very important. It is also required that these resins are characterized by high pull-off strength of the coating. Epoxy resins are also susceptible to the thermal loads, mainly after exceeding the glass transition temperature. The glass transition temperature is often exceeded, e.g. when spinning forklift wheels. There is a serious and common problem.



Epoxy resins are very expensive and synthetic. Therefore, there is a need to find a solution to reduce the total mass of these resins used to make the coatings. For this purpose synthetic and usually non-renewable powders are used. This makes these attempts not environmental friendly and not in line with the sustainable development. On the other hand wastes from the extraction and processing of mineral resources are nowadays not re-used. These wastes contains quartz, alumina or limestone fine powders. They are extremely hazardous in this form, because they may cause pneumoconiosis, respiratory failure, idiopathic pulmonary fibrosis and even increase the likelihood of cancer. Thus, the main novelty of this project is to decrease the hazardous effect of waste mineral powders due to its utilization in hardened epoxy resin coatings. The research aim of this project is the experimental evaluation of the influence of the content of waste mineral powders (such as quartz, feldspar-quartz, lime and basalt mineral powders) on the fundamental properties of epoxy resin floors (such as density, viscosity, contact angle, compressive, tensile and flexural strength, hardness, impact resistance, glass transition temperature and pull-off strength). The powders are not so harmful when they are kept inside the resin instead of stored on landfills. This will also reduce the total mass of the resins, reduce the amount of waste stored on landfills, minimize their overall harmful effect and cost of production. To achieve these motivations a systematic fundamental research should be done. The current research knowledge contain many research gaps. Firstly, the research to date mainly concerns epoxy resins, not epoxy resin coatings. Secondly, only single properties of epoxy resins were tested. Finally, there are not any comprehensive studies on the influence of adding mineral waste powder to the epoxy resin coatings on its fundamental properties. It is not known how the incorporation of powders into epoxy resins will change its consistency, viscosity and related to them properties. How should be model the viscosity of filled epoxy resins with waste mineral powders? Is there any relation between the viscosity and the contact angle of the modified epoxy resins? Is it possible to estimate the viscosity of the modified resins at any stage of the hardening process? How does the contact angle change over time when the epoxy resin is mixed with the hardener and the hardening process begins? Is it possible to deduce from this research what the ideal moment for applying the epoxy resin coating is? What will be the balance between the wettability and hardened properties? Which powder and what amount of it will be optimum? Will these powders may improve the thermal properties of epoxy resin coatings? Getting the ANSWER for each of the following research questions is the aim of this project. The main result of the project will be conducting comprehensive research on the physical, mechanical and thermal properties of the epoxy resin coatings with waste mineral powders. These research will allow finding a solution that improves the durability of the epoxy resin coatings, as well as allow to recycle the waste mineral powders.