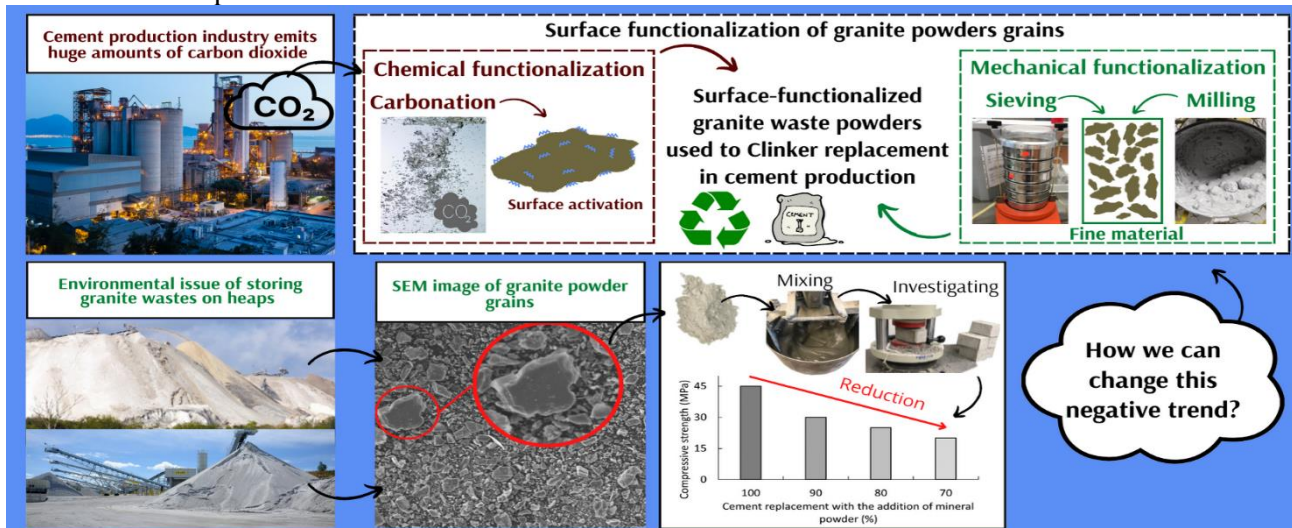




## Experimental analysis of the properties of eco-friendly cementitious composites modified with surface-functionalized granite powder sourced from quarry waste (REUSE)

Cement is the 2<sup>nd</sup> most used material in the world (just after water) and almost 5% of world production of CO<sub>2</sub> is emitted by the cement industry. Finally, it has a negative impact on the environment. Therefore, analysing the possibility of changing the cement industry into more sustainable way, should be implemented: **#1 – reprocess of wastes** and **#2 – consume less clinker**. Granite quarry waste are co-products of crushing, cutting or polishing of mineral rocks. For now the granite powder wastes have not been used in industry. This type of powder wastes is one of most problematic due to storing on the heaps of mineral powders leads to serious impact on humans (pneumoconiosis, lungs cancer), animals (landslides, migrations) and environmental (pollination, soil pH changes, water pollution). Recently, researchers made the attempts of cement replacement with the addition of mineral powders in cementitious materials. Those research did not led to favourable outcomes due to significant reduction of durability of composites. Low level of justification of utilizing of mineral wastes in cement systems may be improved by using novel techniques of preparing powders. Functionalization of mineral powders based on preparations of grains material in such way to improve some of properties of them. In this project, chemical (carbonation) and mechanical (sieving and milling) functionalization will be used to improve the properties of granite waste powders in such way, to use it to reduce amount of clinker in cement – creating of novel surface-functionalized granite powder-modified cement. Optimal way of **REUSE** of mineral powders sourced from granite quarry waste is to use it in cementitious composites.



The main research goal of the project is the experimental analysis of the properties of eco-friendly cement modified with surface-functionalized granite powders sourced from granite quarry waste. In this project Principal Investigator will develop novel hybrid mechanical-chemical functionalization technique for optimizing the properties of mineral powder wastes. Analysing the literature, it is known how mineral additives perform in cementitious systems (improving packing density, decreasing shrinkage, improving the durability of composites), however still there is a research gap in some areas. To fill those gaps PI would like to achieves main goals of this project:

- Analysis of implementation of different grains surface functionalization methods (chemical and mechanical) on the properties of granite powder waste,
- Studies of chemical and mechanical surface functionalization of granite powder grains,
- Preparing the packing density optimization model for surface functionalized granite powder-modified cement,
- Investigation of synergistic effect of simultaneous use of chemical and mechanical surface functionalization processes of granite powder waste,
- Influence of surface functionalized granite powder-modified cement on hydration of cement pastes,
- Analysis of possibility of reduction of environmental footprint with sustainable use of surface functionalized granite powder-based cement to reduce clinker/cement ratio in novel, eco-friendly cement.

This project will fill a lot of significant research gaps and will cause the creation and development of novel surface-functionalized granite powder-modified cement.