

Experimental evaluation of the properties of epoxy composites modified with coarse aggregate derived from the modernization of pre-war dwelling houses (CARMEL)

The main aim of the project is the complex research of the properties of the epoxy composite modified with the waste coarse aggregate sourced from the modernization of the pre-war residential buildings. There are more than 22% of dwelling houses which were built before the 1946 in the EU-28 countries (European Union and cooperating). While building these structures, mostly wood, bricks, steel and concrete were used. These structures were planned to be operated for maximum 50 years. However after some time the modernization of such structure is needed. During these processes some elements are repaired, another are restored and the other become waste. Nowadays in order to prolong the life-time of waste materials the scientists are looking for modern application for them. Most of them are used as cementitious composites additives, towards the regeneration of sustainable environment. However it is difficult to properly prepare the waste material in order to be capable of using it in cementitious composites. Also there are some issues which should be overcome while designing such mixtures. The main issue is the fact that such waste materials as waste bricks and concrete are increasing the water absorption and require very often more superplasticizer in order to maintain workability of cementitious composites mixture on acceptable level. Another issue which should be kept in mind is the fact that in case of waste materials obtained from buildings after 50 years of using, the chemical composition is far from the one at the beginning. It may also not be compatible with and desirable in cementitious composites mixtures. Therefore it makes more difficult to freely use these materials as cementitious composites additives. In this case more reasonable might be usage of epoxy resin as a binder. However even though, the epoxy resins are widely used and described in the literature, they are not very often modified with coarse aggregate. Their usefulness has been proved in pavements, but in the case of epoxy resin – waste material composites still there is a huge research gap that should be filled. Especially that the problem of waste materials sourced from modernization of pre-war residential buildings will be increasing. For this purpose and the sake of the environment the conducted research and provided analyses will answer following questions: How morphologically different in comparison to the natural aggregate could be the aggregates obtained from the modernization and demolition of pre-war buildings?; How efficient, in comparison with the cementitious composites, could be using epoxy resin as a binder in waste material consumption?; What influence will have using waste coarse aggregate at the epoxy resin properties?; What amount of coarse aggregate added to the epoxy resin will make it more cementitious composite alike and when it still behave as a resin?; What properties, comparing to the cementitious composites, will have the interphase transition zone?; Which properties of such composite of the epoxy resin and coarse aggregate will be improved?; If it is possible to recycle this epoxy resin modified with coarse aggregate in a similar way it was made of? Answering these questions might be beneficial not only for sustainable development but also for the future researchers investigating properties of epoxy resin modified with coarse aggregates derived from different sources. For this purpose the carried out test will contain: investigation of morphological properties of waste concrete and bricks sourced from the modernization of the pre-war residential buildings; analytical and experimental evaluation of the properties of epoxy resin modified with the afore-mentioned coarse aggregate; economical and mechanical justification of such solution and potential reusability of epoxy resin modified with the coarse aggregate sourced from the modernization of the pre-war residential buildings. These research is also a very promising option to stop European Union from being flooded by the waste obtained from modernization, restoration and demolition of buildings which were built before 1946. The innovative research character of the project is underlined by examining the properties of the epoxy resin modified with the coarse aggregate sourced from the modernization of the pre-war residential buildings. Especially evaluating the reusability of this material will decrease the potential carbon footprint during life-time and is in common with the circular economy. It is also innovative to perform experimental tests of “natural” size elements other than pavements. Equally important is the fact that binding the coarse aggregate with the epoxy resin may overcome issues connected with the water absorption and workability of cementitious composites mixtures.