Evaluation of sulfur concrete technology for local applications

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Abstract:

This part of the exploratory study pertains to the evaluation of performance of sulfur concrete made of elemental and modified sulfur as binders, locally available crushed limestone as coarse aggregates, dune sand as fine aggregate, and coarse aggregate dust as filler.

The objective of the study was to check and explore feasibility of the use of sulfur-concrete as construction material, using commercially proven binder namely Chempruf concentrate produced by Chempruf Concrete Company, USA, and using locally available aggregates from Saudi Arabia.

For establishing a base line, reasonably workable mix of elemental sulfur concrete, using elementary sulfur was included in this study. The sulfur-concrete mix design recipe, as recommended by the Chempruf Company using their binder and aggregates from Eastern Province, Saudi Arabia was used.

The samples of the elemental and modified sulfur concrete were cast to perform the compressive strength, tensile strength, water absorption, and gas emission tests. The samples subjected to normal and repeated heat-cool exposures were tested for strengths and water absorption. Test results were found to be in agreement with the reported values for modified sulfur concrete. Test results confirm the fact that the modified sulfur concrete has better performance as compared to the elemental sulfur concrete. The samples exposed to wet-dry cycles and acids disintegrated to an extent not suitable for either the strength testing or the absorption testing. The reason for this failure in prolonged exposure to aquatic environment appears to lie with the poor quality of aggregates used. Gas emission tests showed that the modified sulfur concrete is not a health hazard even at an elevated temperature of 60 ºC, as the emission of harmful gases are within the safe permissible limits.

The comparison of the compressive and tensile strength of limited samples with those reported in the literature shows that they are acceptable even with the use of poor quality marginal limestone type of aggregates. However, failures of test samples with respect to water and acid resistance tests shows that the technology needs to be further evaluated using better quality aggregates from Western Province. Therefore, sulfur-concrete technology using commercially proven binder in combination with aggregates from Eastern Province, Saudi Arabia, is not recommended.