

Characteristics of the Mortars Obtained by Radioactive Recycled Sand

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Abstract : At the end of 2011 worldwide there were 124 power reactors shut down, from which: 16 fully decommissioned, 50 power reactors in a decommissioning process, 49 reactors in "safe enclosure mode", 3 reactors "entombed", for other 6 reactors it was not yet have specified the decommissioning strategy. The concrete radioactive waste that will be generated from dismantled structures of VVR-S nuclear research reactor from Magurele (e.g.: biological shield of the reactor core and hot cells) represents an estimated amount of about 70 tons. Until now the solid low activity radioactive waste (LLW) was pre-placed in containers and cementation with mortar made from cement and natural fine aggregates, providing a fill ratio of the container of approximately 50 vol. % for concrete. In this paper is presented an innovative technology in which radioactive concrete is crushed and the mortar made from recycled radioactive sand, cement, water and superplasticizer agent is poured in container with radioactive rubble (that is pre-placed in container) for cimentation. Is achieved a radioactive waste package in which the degree of filling of radioactive waste increases substantially. The tests were carried out on non-radioactive material because the radioactive concrete was not available in a good time. Waste concrete with maximum size of 350 mm were crushed in the first stage with a Liebherr type jaw crusher, adjusted to nominal size of 50 mm. Crushed concrete less than 50 mm was sieved in order to obtain useful sort for preplacement, 10 to 50 mm. The rest of the screening > 50 mm obtained from primary crushing of concrete was crushed in the second stage, with different working principles crushers at size < 2.5 mm, in order to produce recycled fine aggregate (sand) for the filler mortar and which fulfills the technical specifications proposed: -jaw crusher, Retsch type, model BB 100; -hammer crusher, Buffalo Shuttle model WA-12-H; presented a series of characteristics of recycled concrete aggregates by predefined class (the granulosity, the granule shape, the absorption of water, behavior to the Los Angeles test, the content of attached mortar etc.), most in comparison with characteristics of natural aggregates. Various mortar recipes were used in order to identify those that meet the proposed specification (flow-rate: 16-50s, no bleeding, min. 30N/mm² compressive strength of the mortar after 28 days, the proportion of recycled sand used in mortar: min. 900kg/m³) and allow obtaining of the highest fill ratio for mortar. In order to optimize the mortars following compositional factors were varied: aggregate nature, water/cement (W/C) ratio, sand/cement (S/C) ratio, nature and proportion of additive. To confirm the results obtained on a small scale, it made an attempt to fill the mortar in a container that simulates the final storage drums. Was measured the mortar fill ratio (98.9%) compared with the results of laboratory tests and targets set out in the proposed specification. Although fill ratio obtained on the mock-up is lower by 0.8 vol. % compared to that obtained in the laboratory tests (99.7%), the result meets the specification criteria.

Keywords : characteristics, radioactive recycled concrete aggregate, mortars, fill ratio

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