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Valorisation of stainless steel slags: Zero Waste concept

Dirk VAN MECHELEN, Evelyne NGUYEN, Sven RIJSKENS

Recmix Belgium BVBA

dirk.van.mechelen@telenet.be

Abstract

In Belgium annually about 500000 ton of stainless steel slags are processed to recuperate the metal. 70% of the slag treated can be recycled as coarse and fine aggregates. The remaining 25% of the slag is fine grained, mainly smaller than 500 micron, characterised by elevated leaching of chromium and molybdenum and high water absorption. The reuse of these fines is nearly impossible. The extreme high water absorption makes the use as a filler in concrete impossible. The reuse of the fines for agricultural application is forbidden due to the elevated leaching of chromium and molybdenum. Research is going on to investigate the possibilities to improve the slag solidification and slag stabilisation to minimise the amounts of fines. This research is not limited to the use of additives for stabilising the slags but also targets the improvement of the cooling cycles. The metal content of the coarse aggregates is high enough so that it will be profitable to grind all the slag particles down to small sizes to liberate all metal particles. This approach can be successful if the fines can be reused in competitive products. Aggregates from stainless steel slag, cured in a proper way, are characterised by a high polished stone value (PSV) and perform very well in bituminous surface treatments for roads. Fines can be granulated with a binder (cement...) or without a binder (CO_2...) to produce pellets. Pellets can be used as artificial aggregates in concrete applications, or injected in the furnace as a cheaper alternative for raw materials, or as carrier for refractory dust, fine sized metals... Depending on the mineralogy, slag aggregates can be milled down to minus 60 micron to produce a high quality filler recuperating nearly all stainless steel metal. This specific type of stainless steel slag filler, is performing even better in self compacting concrete, compared to limestone fillers. A new technology is developed to produce high strength building materials by treating slags with CO_2 without addition of binders. Carbonated materials can compete with concrete products and have excellent environmental and technical properties. Zero waste valorisation of stainless steel slags is only feasible if the concept of an optimised mix of products, imposed by the short term demands of the market, is followed.