Development of low-carbon cements (LCCM) by alkaline activation technology

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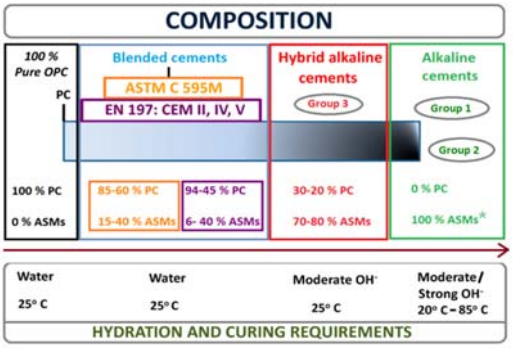
Portland cement (PC) manufacturing contributes significantly to energy consumption, greenhouse gas (GHG) emissions and natural resource depletion. PC production increases by 7-8 % annually and its manufacture accounts for 7-9 % of total GHG production. In order to reduce CO_2 emissions, the cement industry's roadmap includes, among other options: increasing the content of supplementary cementitious materials (SCMs) to replace Portland cement clinker or making clinker-free cements. By applying alkaline activation technology [1-5], both options are possible to produce low-carbon cements -(LCCM). Alkaline cements (AC) are obtained by the physical-chemical interaction of materials (aluminosilicates) from natural origin or industrial waste (with amorphous or vitreous structures) with alkaline activators. Hybrid alkaline cements (HAC) are multi-component systems containing a high percentage of mineral additions (dehydroxylated clays, fly ash, slag, mining waste, etc.), low proportions of Portland clinker (<30 %) and a small proportion of activators (solids or liquids) of moderate alkalinity (Na_2SO_4, $NaCO_3$, NaCl, ...). At this point, it is important to highlight the great versatility in terms of the materials used in these cements, which allow the recovery of waste from other industries. The use of alkaline activation technology therefore allows the development of new sustainable materials with low CO_2 emissions, in addition to the recovery of by-products or industrial waste, avoiding the overexploitation of natural resources and favouring the circular economy.



Acknowledgments: This works has been funded by the Spanish Research Agency (AEI), the Spanish Ministry of Science and Innovation and the ERDF (research Project PID2022-138637OB-C31/AEI/10.13039/501100011033 /FEDER, UE).

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