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ALKALI ACTIVATION OF SYNTHETIC GAMMA DI-CALCIUM SILICATE WITH PURE CALCINED NATURAL CLAYS

Stainless steel slag such as Argon Oxygen Decarburization (AOD) and continuous casting (CC) slag are crystalline in nature and primarily rich in gamma di-calcium silicate (Y-C_2S), which has poor hydraulic properties. Therefore, the use of these slags as a hydraulic binder is unfavourable in building materials. Mechanical and chemical activation of Y-C_2S increased the hydraulic reactivity of Y-C_2S and transformed it into a reactive hydraulic component. This investigation aims to transform the synthetic Y-C_2S into a single reactive binder system by mixing it with pure calcined natural clays such as kaolinite (>95 wt%), Na- and Ca-montmorillonite (90-95 wt%), and to study the effect of using clays on the hydraulic properties. 10M NaOH Solution has been used as an alkali activator for these mixes with solution to binder ration equal to 1.

	Calcined Kaolinite	Calcined/purified Ca-MMt	Calcined/purified. Na-MMt	Y-C_2S
SSA (m^2/g)	11.01	75.30	30.83	8.84
Si/Al molar ratio	1	3.8	2.6	

*Ca-MMt is calcium montmorillonite, Na-MMt is sodium montmorillonite .

Table 1. specific surface area and Si/Al molar ratio of the raw materials.

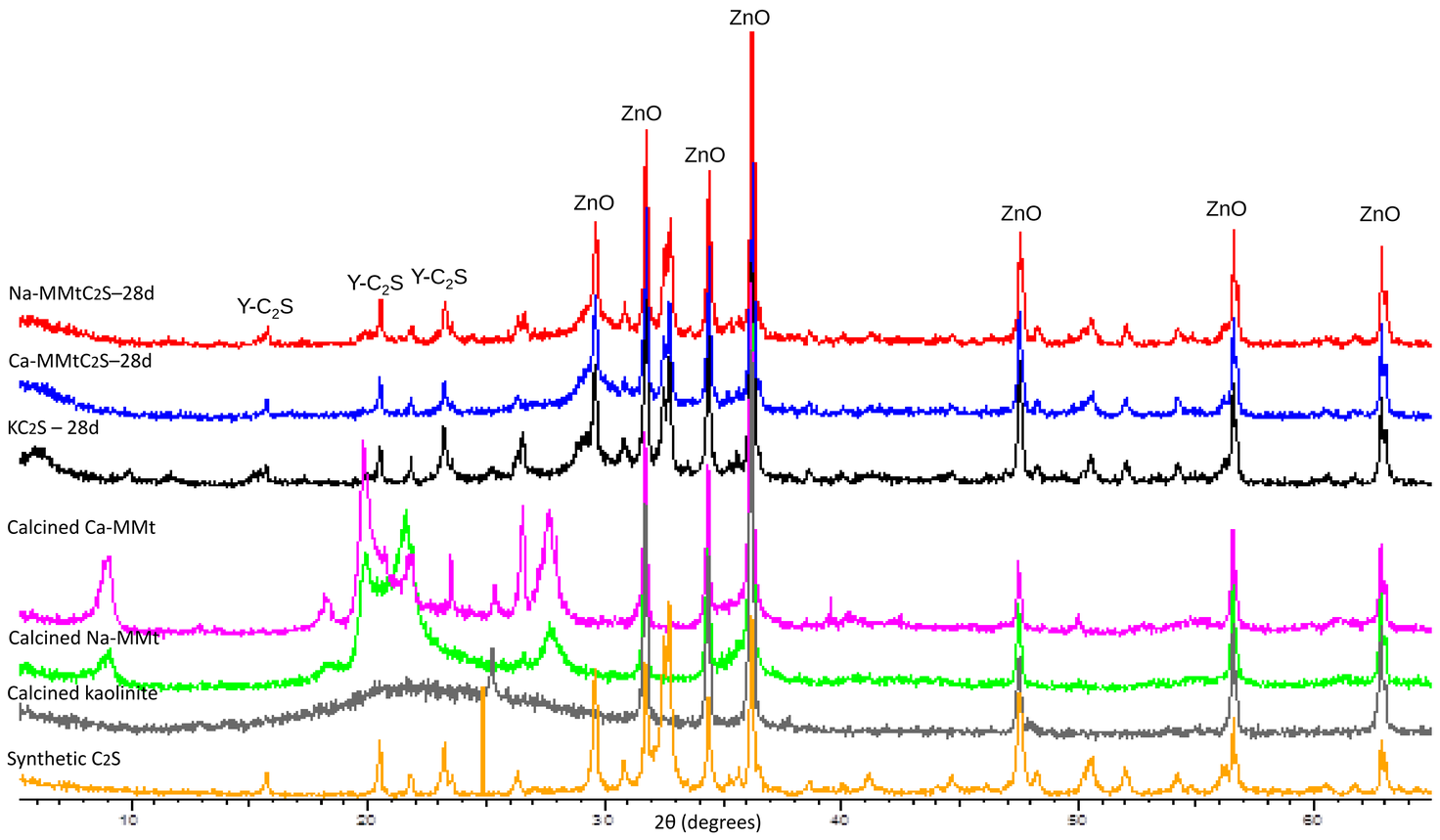

Figure 1. XRD pattern of alkali activated clay/Y-C_2S mixtures at 28 d and the raw materials.

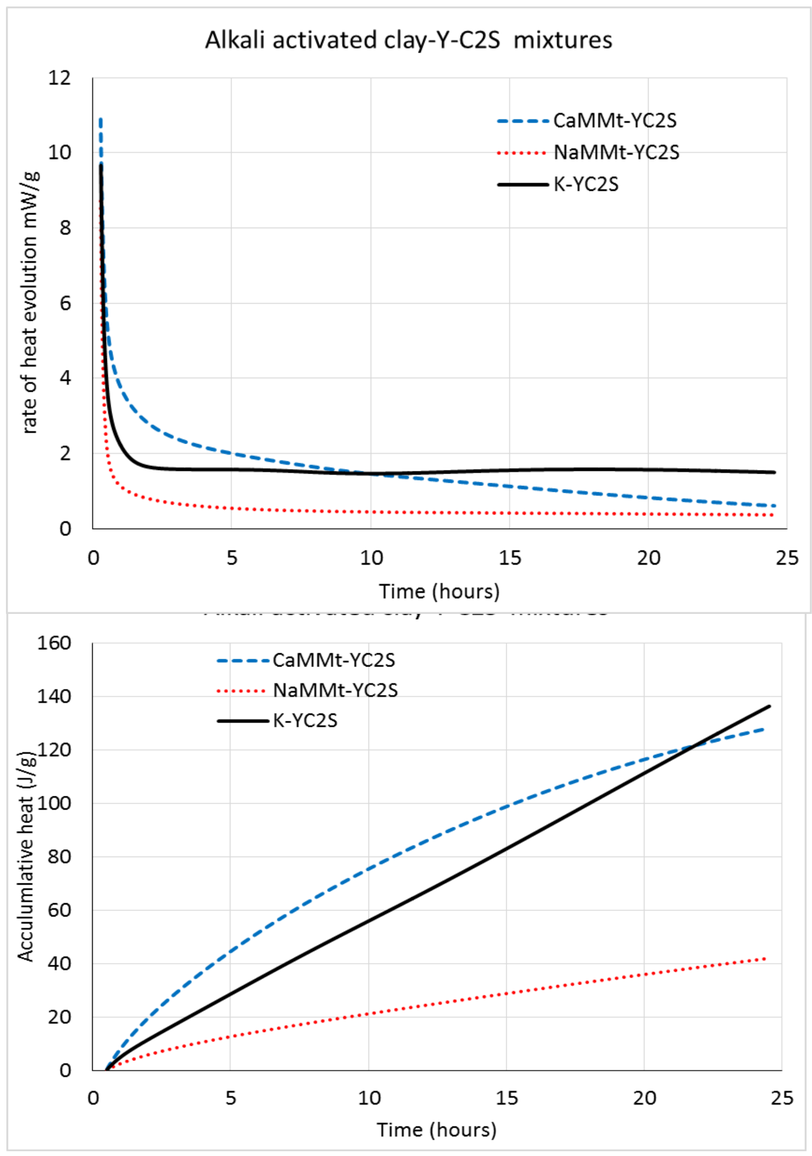

Figure 2. Isothermal conduction calorimetric of alkali activated clay- Y-C_2S mixtures at 20 °C.

The rate of heat evolution of the Ca-MMt/YC_2S mixture is slightly higher than K/YC_2S and Na-MMt/YC_2S mixtures, this is due to the high Si/Al molar ratio, which enhance the dissolution reaction of the aluminosilicate oxides. In addition to this, the high specific surface area, which increase the reactivity of the materials, yet, the rate of the hydration reaction is slow for the three mixtures. One possible explanation for the prohibition of the reaction is that the system was under high alkalinity conditions, which hindered the formation of the reaction products by slowing solubility of Ca^{+2} ions. The pattern of the accumulative heat of hydration shows that the total heat release with the Ca-MMt/YC_2S is higher than K/YC_2S and Na-MMt/YC_2S. The same approach can be easily noted in Figure 1, where the XRD pattern of the raw materials and the alkali activated mixtures after 28 days of reaction is shown. It's difficult to identify the reaction products from XRD; the amorphous nature of the hydration products might be the main reason in addition to the low amount of these products.

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