Phase and microstructural characterization of lime-MK blended mixes

André Gameiro[1, a], A. Santos Silva[2,b], R. Veiga[3,c] and A. Velosa[4,d]

[1] National Laboratory of Civil Engineering, Av. do Brasil, 101, Lisbon, Portugal

[2] National Laboratory of Civil Engineering, Av. do Brasil, 101, Lisbon, Portugal

[3] National Laboratory of Civil Engineering, Av. do Brasil, 101, Lisbon, Portugal

[4] Department of Civil Engineering, Geobiotec, University of Aveiro, Aveiro, Portugal

[a] agameiro@lnec.pt, [b] ssilva@lnec.pt, [c] rveiga@lnec.pt, [d] avelosa@civil.ua.pt

Abstract. Metakaolin (MK) is nowadays a well-known pozzolanic material used in cement-based materials. Its benefits are related to its great pozzolanic reactivity when compared with some others pozzolanic materials, like fly ash or ground-granulated blast furnace slag.

When MK reacts with calcium hydroxide, cementitious products are formed. It is known that the main phases produced during its pozzolanic reaction at ambient temperature are calcium silicate hydrates (CSH), stratlingite (C_2ASH_8) and calcium aluminate hydrate (C_4AH_{13}). However, in literature there are several discrepancies regarding these phases stability, namely the transformation of stratlingite and C_4AH_{13} into hydrogarnet (C_3AH_6) at long term. The consequences of that instability are a reduction in the porosity and a loss of microstructural strength that can induce a complete material degradation.

The MK is a material with great potential in Portugal, since there is a large abundance of kaolinitic clays, however its development is not yet achieved. In order to answer this demand a research project was initiated with the aim of optimizing the production of MK in Portugal and enhancing the durability of aerial calcitic lime mortars, to be mainly used in conservation and restoration of historical buildings.

With the objective of studying the compounds formed in lime/MK and their stability during time, we have prepared different lime/MK ratio pastes (molar ratios). These lime/MK pastes were stored at saturated conditions (RH > 95%) and 23 ± 2 ºC temperature being analysed at several ages by TGA-DTA, XRD and SEM-EDS. In this paper the results obtained are presented and discussed.