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IR-Thermography as a non-destructive tool for the physical-mechanical characterization of alkali activated binders and mortars produced by using volcanic ashes from Mt. Etna volcano (Italy)

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The European Green Deal has as prerogative the environmental sustainability through the reduction of CO_2 emission into the atmosphere mainly deriving from the industrial sector. In such a context, the alkali activated materials (AAMs) are assumed as a "green" alternative to traditional concrete with high potentiality of use in different application fields (e.g., restoration of built heritage). AAMs are produced by mixing solid aluminosilicate precursors with alkaline activators. According to this foreword and the satisfying results of previous studies on AAMs based on volcanic ash from Mt. Etna volcano (Italy), in this contribution we propose a comparison, at laboratory scale, between AA-binders and AA-mortars. In particular, four different set of samples were prepared, two of which (binders) through the addition of specific quantities (10 and 20 wt.%, respectively) of metakaolin (MK) as solid additive. The mortars were manufactured by adding 30 wt.% of pyroclastic aggregate (< 2 mm) to the previous binders and then mixing with 2 wt.% of tap water to achieve a satisfying workability. All samples have been shaped with a small cubic size (2x2x2 cm). Afterwards, the four AAMs series have been cured for 28 days before being analysed to ensure the total hardening. The following analytical techniques have been then applied to assess the physical-mechanical behaviour of the tested materials: i) infrared thermography to evaluate the rate of heat release during the natural cooling of samples; ii) capillary water absorption test to assess their hydric behaviour as a function of textural features and pore structure; iii) uniaxial compressive test; and iv) drilling resistance test. Results deriving from IR-thermography were correlated with the other physical-mechanical properties empirically investigated. The good correlation found demonstrates the potentiality of this non-destructive method as a tool to obtain immediate and indirect feedbacks of other properties commonly investigated by using destructive methods.

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