Geopolymers for the conservation of tiled facades

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Glazed ceramic tiles from the 19th and 20th centuries cover a significant amount of facades in Portugal's built heritage. Production and exposure conditions, linked to differential expansion characteristics cause degradation of the ceramic body and glaze. Conservation actions must frequently intervene using reintegration techniques that fill gaps and cracks. For this purpose, a variety of materials have been used, from lime pastes to organic resins, but the achievement of compatible solutions is still an issue in need of further research. Geopolimeric materials are a possible solution as they may be formulated using similar raw materials and may achieve a variety of properties that must be in accordance with those of old tiles in order to produce successful reintegrations.

For this study, geopolimeric materials were developed and tested and a comparison was performed in relation to traditionally used polymers. Geopolymers were developed with a metakaolin base and three different basic formulations were studied. Formulations GEO-MKZL, GEO-MK1000 and GEO-MK1000C are described in Table 1 and further variations were performed in terms of the final pH of these materials. The main drawbacks were ageing and cracking of some compositions as well as salt formation (Figure 1). Therefore, pH control was performed in order to minimize cracking, influencing the aggregation of the membrane and matrix during geopolymer processing. The testing procedure encompassed artificial ageing, mechanical strength, water absorption and water vapour permeability. Adhesion of the geopolymers to the ceramic body was also evaluated. With results from this set of tests, compatibility issues may be evaluated. Results showed that the used geopolymers present a significant variation of properties, that may be adapted to the range of properties exhibited by glazed tiles of semi-industrial production. In comparison with materials of current use in conservation practice, geopolymers may constitute a valid substitute for use in reintegration procedures.

GEOMETRIC COMPOSITION

GEO-MKZL	GEO-MK1000	GEO-MK1000C
– Metakaolin and natural zeolite – Sodium Hydroxide	– Metakaolin – Sodium Hydroxide and calcium hydroxide	– Metakaolin – Cork Ash

FIGURE 1
Geopolymer compositions.

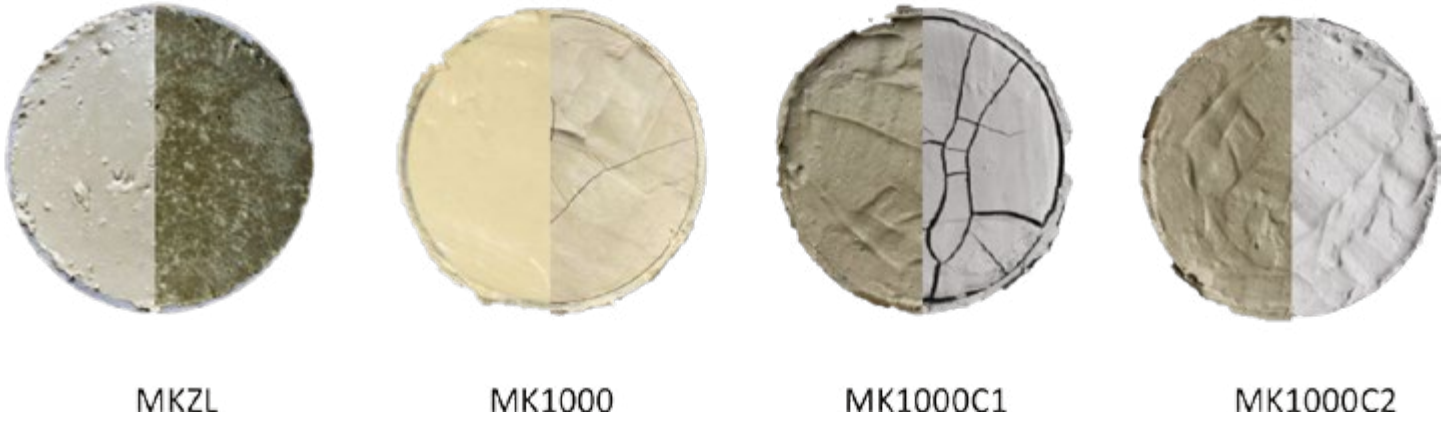

FIGURE 2
Geopolymer compositions at day 1 and 15.