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Discerning between natural and artificial pozzolanic materials by FTIR spectroscopy)

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Discerning between natural (i.e. *pozzolana*) o artificial (i.e, crushed bricks or ceramics) pozzolanic materials in hydraulic plaster and mortars is usually performed by means of Optical Microscopy (OM) thin section observation, by thermal techniques (TGA-DTA) and XRD analysis. (Chiari et al., 1992; Moropoulou et al., 2005, 1995). In the present work a new option based on FTIR spectroscopy is proposed. FTIR spectra collected on geological material (Pozzolana di Torre del Greco, Museo Regionale di Scienze naturali) and a certified reference material (SARM69 powdered ceramic, MINTEK**,** Johannesburg, SA) indicate the possibility of discriminating between *pozzolana* and ceramic materials in typical 1170-470 cm^{-1} frequency range. Analysis of archaeological mortar fragments, containing *pozzolana* and crushed ceramic respectively, confirms the suitability of the proposed FTIR technique in discerning between natural and artificial pozzolanic materials on real samples. Nature of the pozzolanic aggregate in these samples was previously ascertained by mean of OM, XRD, TGA and SEM-EDX.

FTIR is a fast and economic technique, both in sample preparation and analysis and could be usefully applied when a great number of samples has to be examined, as an alternative to the XRD technique in the case of disaggregated samples or when pozzolanic materials are present in the form of fine particle, i.e. below the resolving power of the OM. Finally, a scale-up to portable equipment could allow *in situ* determinations leading to the mapping of the different technological horizons in an archaeological site or complex.

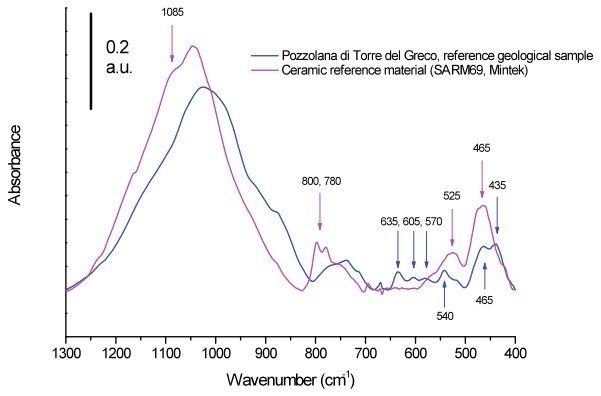

Figure 1 : FTIR spectra of reference materials

[1] Chiari, G., Santarelli, M.L., Torraca, G., 1992. Caratterizzazione delle malte antiche mediante l'analisi di campioni non frazionati. Mater. e Strutt. Probl. di Conserv. II, 111–137.
[2] Moropoulou, A., Bakolas, A., Anagnostopoulou, S., 2005. Composite materials in ancient structures. Cem. Concr. Compos. 27, 295–300.
[3] Moropoulou, A., Bakolas, A., Bisbikou, K., 1995. Characterization of ancient, byzantine and later historic mortars by thermal and X-ray diffraction techniques. Thermochim. Acta 269–270, 779–795.