HMC 2016

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Scientific Program

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Santorini, Greece

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Dept of Civil Engineering
Aristotle University of Thessaloniki

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11:00 - 11:30	**Coffee break**	
11:30-13:15	**Session X / Repair mortars for historic masonry** Hall A **Chair**: Rob Van Hees, Ana Velosa	**Session XI / Repair mortars for historic masonry** Hall B **Chair**: Suzana Slizkova, Ana Radivojevic
11:30 - 11:45	**Wood ash as an Additive: a Study of its Influence on the Physical Properties of Lime Mortars**, Lucie Fusade, Heather Viles	**Restorative Waste-based Lime Mortars with Inclusion of Spent Cooking Oils,** Parsa Pahlavan, Stefania Manzi, Maria Chiara Bignozzi
11:45 - 12:00	**The use of a lignosulfonate superplasticizer in repair air lime-metakaolin mortars**, M. Pérez-Nicolás, A. Duran, R. Sirera, I. Navarro-Blasco, J.M. Fernández, J.I. Alvarez	**Experimental study of bond strength developed between traditional type bricks and lime-based repair mortars,** Dimitris Papadimitriou, Ioanna Papayianni
12:00 - 12:15	**Behaviour of air lime-metakaolin mortars modified with polynaphthalene sulfonate as superplasticizer**, A. Duran, R. Sirera, M. Pérez-Nicolás, I. Navarro-Blasco, J.M. Fernández, J.I. Alvarez	**Mechanical and durability properties of lightweight mortars for the backing of ancient mosaics**, Sabina Kramar, Martina Lesar-Kikelj
12:15 - 12:30	**Preliminary study on the use of ammonium phosphate for the conservation of marble-imitating gypsum-stuccoes**, Enrico Sassoni, Gabriela Graziani, George W. Scherer, Elisa Franzoni	**Fiber- reinforced lime mortars**, Maria Stefanidou, Michael Papachristoforou, Fotini Kesikidou
12:30 - 12:45	**Pompeian stucco plaster without aggregates: a case study of reconstruction**, Christian Kaiser, Katrin Wilhelm, Ronja Emmerich	**Comparative study for water protection of traditional packed floor mortars,** Katia Matziaris, Maria Stefanidou, George Karagiannis
12:45 - 13:15	Discussion	Discussion

Behaviour of air lime-metakaolin mortars modified with polynaphthalene sulfonate as superplasticizer

A. Duran[1], R. Sirera[1], M. Pérez-Nicolás[1], I. Navarro-Blasco[1], J.M. Fernández[1], J.I. Alvarez[1]

[1] MIMED Research Group, Department of Chemistry and Soil Science, School of Sciences, University of Navarra, Spain, jalvarez@unav.es, mimed@unav.es

A new range of repair lime mortars were obtained by using as superplasticizer a polynaphthalene sulfonate-based polymer (PNS). In some mortars the simultaneous addition of metakaolin as a Supplementary Cementitious Material was also tested.

In the fresh stage, PNS showed a clear dosage-response pattern: the higher the PNS dosage, the larger the slump values of the fresh pastes. PNS was helpful in most of cases to reduce the setting time in comparison with SP-free pastes: this fact could be useful to shorten the extended setting times that is a well-known problem ascribed to the use of air lime mortars in repairing works of the Built Heritage.

Adsorption isotherms showed that PNS exhibited a high affinity for air lime particles with 52.08 $mg \cdot g^{-1}$ as maximum sorption capacity in pure air lime media. Mathematical treatment of experimental data showed an optimal adjustment to a Freundlich model, in which interactions arising from multilayer adsorption are taken into account. The experimental results suggested a great interaction of PNS with air lime media (pure air lime or air lime with pozzolanic additives). Zeta potential curves of air lime systems titrated with PNS showed a larger zeta potential reduction, giving rise to a charge reversal, as a consequence of the high anionic charge density of this polymer (2.44 meq of anionic $charge \cdot g^{-1}$).

A flat adsorption was proposed as the attachment model of this admixture, owing to its higher anionic charge density and to its linear shape. The attached molecules could be surrounded by the growing carbonation/hydration products, yielding inactive organo-mineral phases. The electrostatic repulsion was then the main action mechanism to explain the PNS function. In the hardened state, the combination of PNS and MK resulted sometimes in moderate mechanical strength increases, although a certain interaction with the C-S-H formation was also seen.

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MIMED Research Group

Department of Chemistry, School of Sciences, University of Navarra, Spain.

mimed@unav.es

Introduction

Generally, plasticizers or so called **superplasticizers** (depending on their action capability) are organic molecules added in low percentages (usually below 0.5%) to fresh binding mixtures **aiming to reduce the mixing water and improving the fluidity**.

For repair air lime mortars and grouts, these superplasticizers appear as potentially applicable admixtures with the purpose of

- **keeping a good flowability** of the plastic mixtures.
- **enhancing the mechanical resistance** as a consequence of a lower porosity.

Introduction

In addition, the simultaneous use of a pozzolanic additive, such as the well-known metakaolin (MK), could yield mortars and grouts with suitable

- **consistency**,
- **setting times** and
- **final mechanical strengths.**

From the point of view of the scientists devoted to **Built Heritage**, the investigation on these issues broadens the knowledge about materials that could be applied for **restoration processes**.

Conclusions

- The incorporation of PNS **increased the slump of the MK-added air lime**
- **PNS** showed a **poor dispersion maintaining ability**
- **The flat adsorption of PNS** and ulterior formation of organo-mineral phases seems to be responsible for this behaviour.
- Adsorption isotherms revealed a **high consumption of this admixture in MK-air lime samples.**
- A **positive effect of the combination of PNS and MK** was found in terms of **mechanical strengths as well as durability** (freezing-thawing and sulfate attack).