WASCON2015

Resource Efficiency in Construction

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9th International Conference on the Environmental and Technical Implications of Construction with Alternative Materials

BOOK OF EXTENDED ABSTRACTS

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Organized by:

ISCOWA

UC UNIVERSIDAD DE CANTABRIA

GER Research Group
Green Engineering & Resources

LADICIM
LABORATORIO DE LA DIVISIÓN DE CIENCIA E INGENIERÍA DE LOS MATERIALES

INGEPRO

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GITECO Research Group – Universidad de Cantabria
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FOREWORD

WASCON is the reference international conference on the use of alternative materials (secondary raw materials) in construction. The first WASCON conference was launched in 1991 by a group of scientists from Europe and North America. At that conference it was decided to found ISCOWA, the International Society for Construction with Waste materials. This initiative started an important movement around waste recycling in construction. The WASCON conferences became and remain the main activity of ISCOWA, and were from then on held every three years, i.e. in 1991, 1994, 1997, 2000, 2003, 2006, 2009 and 2012.

At WASCON 2012 in Gothenburg it was announced that WASCON 2015 would be organized in Santander, Spain, in collaboration with GER, the Green Engineering and Resources Research Group of the University of Cantabria, one of the top 10 Spanish Universities. GER consists of a group of active researchers whose research focuses on waste valorization, environmental information management and decision support tools, and process systems. The group actively interacts and collaborates with the community, the administration, industry and other research groups.

For WASCON 2015 the general theme **Resource efficiency in construction** was selected. On this memory stick you will find the proceedings of WASCON 2015, containing 60 extended papers, submitted by authors from 24 countries. The number, the variety and the quality of the papers indicate that WASCON still responds to a real need. I hope that these proceedings, a new extension of the large WASCON library (initially books, then CD-ROMs and now memory sticks), will provide ideas for commercial application and development, inspiration for future research and projects, and information useful for finding project partners.

Materials' recycling is enjoying more and more support e.g. from the EC that promotes Europe as a recycling society and the transition from the current linear economy towards a future Circular Economy. A sustainable society with a Circular Economy cannot be realised with an unsustainable construction sector. To date, the construction sector has much interest for Energy Efficiency (saving energy by insulation, construction of passive houses, innovative ways of efficient heating and cooling, production of renewable energy, etc.). We believe that recycling of materials, Resource Efficiency, in construction is of similar importance. Moreover, producing building materials from recycled materials, instead of from virgin raw materials may also save energy and emit less greenhouse gases. The future recycling society in a circular economy is however not possible without respect for environment and safety. New production techniques and new business models will be necessary to realize this recycling society and a circular economy. This and earlier WASCON conferences have shown several examples or niches that can contribute to this development. In order to reach a true recycling society and a circular economy, the niches must be transformed to norm via systemic eco-innovations, as described in the report "From Niche to Norm"[1] . This transformation will need a lot of effort by all stakeholders: science, industry, government as well as citizens. Therefore, the dual mission of ISCOWA "to promote and coordinate the exchange of information regarding the environmental and technical aspects of construction with industrial by-products" is today even more relevant than it was twenty-four years ago.

We hope that you will appreciate the scientific program and enjoy the social program with the wine reception, the boat trip and the Gala dinner.

Finally, the autonomous region of Cantabria is a privileged region due to its high quality of life. It combines with a mild climate other important elements such as art and nature, history and leisure, tradition and gastronomy. Situated between sea and mountain, it has the typical characteristics of an Atlantic climate with mild temperatures all year round. Santander, its capital, is a wonderful cultural and historical city with a friendly atmosphere. The city appeared to us the ideal location for WASCON 2015.

Prof. Carlo Vandecasteele
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Chairman of ISCOWA

[1] From Niche to Norm: Suggestions by the Group of Experts on a 'Systemic Approach to Eco-Innovation to achieve a low-carbon, Circular Economy', EC, 2015, http://bookshop.europa.eu/es/from-niche-to-norm-pbKI0115206/

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Ladle furnace slag in cement mixes: experimental studies

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Abstract

One of the most important by-products of the steelmaking industry is the ladle furnace basic slag, generated after the secondary or basic refining of steel. Over the last decades, several research groups have analyzed their instabilities, their mineralogy, their hydraulic reactivity and their application in construction materials. These sustainable uses are based on the reactivity of certain compounds at outdoor temperatures such as calcium aluminates, free calcium oxide and free magnesium oxide.

This research work will focus on the characterization of pastes and masonry mortars (non-structural) containing such by-product as a partial replacement of binders (cement) and fine aggregates. In order to do this, authors have investigate on two topics: basic slags LFS characterisation and its application in masonry mortars, from two points of view; mechanical performance (under compression and flexural responses) and durability under weathering ageing (efflorescence studies and wetting-drying cycles).

This paper concludes that the ladle furnace basic slag can induce slight hydraulic reactivity. A partial cement replacement by ladle furnace basic slag lower than 20% by weight does not negatively affect the mechanical performance and durability in cement masonry mortars.

Keywords: Cement mixes; Durability; Masonry Mortar; Shrinkage; ladle furnace slag

Table 5. Wetting-drying accelerated weathering studies

Mortar	Weight variation (%)	Average $Ø_{pore}$ (µm)		Compression strength (MPa				Flexural strength (MPa)			
		0d	1year	28d	90d	180d	1year	7d	90d	180d	1year
MI0-ref.	+0.08	0.35	0.38	17.2	19.2	18.2	19.5	4.5	4.9	5.2	4.6
MI10EB1	+0.09	0.48	0.44	14.1	15.0	14.6	14.4	3.8	4.2	4.3	3.8
MI20EB1	+0.13	0.67	0.44	10.7	12.8	12.3	11.0	2.9	4.1	3.5	2.8

On the contrary to reference mortar, because of the cycle's effect, the average diameter of small pores was reduced (MIP technique), with the consequent lower average pore sizes, probably due to new hydration products, or new phases precipitation associated with the hydration of LFS.

Referred to mechanical behaviour, after 1 year exposure, LFS mortars strengths under compression loads are higher than early ages (0 days), in an average value of 5%, This effect is similar as observed in reference mortar.

Conclusions

- Present research has mainly focused on the characterization of pastes and masonry mortars containing LFS such us a partial substitution of binders (cement) and fine aggregates.
- Authors have investigated on the LFS hydration and expansion processes and the LFS-cement mixes in aspects such as: mechanical behaviour under compression and flexural loads and durability studies under weathering ageing (efflorescence and wetting-drying cycles).
- This paper concludes that the ladle furnace basic slag can induce slight hydraulic reactivity. A partial cement replacement by ladle furnace basic slag lower than 20% by weight does not negatively affect the mechanical performance and durability in cement masonry mortars

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