5th International Slag Valorisation Symposium, 3-5 April 2017, Leuven, Belgium

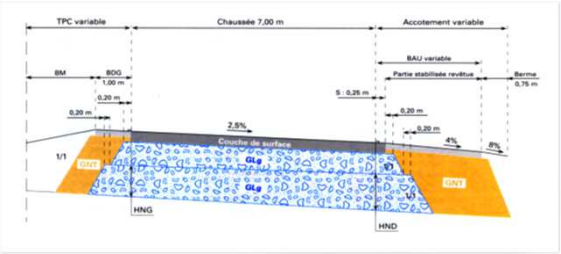
MODULATION OF α COEFFICIENT BY ADDITION OF GROUND BLAST FURNACE GRANULATED SLAG

C. DILIBERTO[1], , L. CHAOUCHE[1], R. TRAUCHESSEC[1], S. EL-BEDOUI[2], A. LECOMTE[1], P. REEB[3], K-J. ARLT[3]

[1] Institut Jean Lamour, UMR/CNRS 7198, Université de Lorraine, Équipe matériaux pour le génie civil, IUTNB, CS 90137, 54600 Villers-les-Nancy, France
[2] Cerema, Direction Territoriale Est, Laboratoire Régional de Nancy, 71 rue de la Grande Haie, 54510 Tomblaine, France
[3] Aktien-Gesellschaft der Dillinger Hüttenwerke, Werkstraße 1, 66763 Dillingen/Saar, Germany

INTRODUCTION

Granulated Blast Furnace Slags (GBFS) can be used as binder in road construction

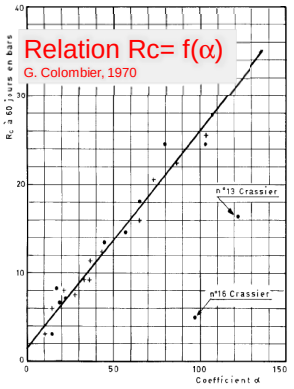


Their reactivity is governed by the α coefficient (EN 13286-44)

$$\alpha = SS \times F$$

SS : specific surface of elements < 80 µm
F : sand friability

Higher is α, better is the reactivity of the slag



Goal: study the **variation of the α coefficient** on **28 GBFS** coming from a same production unit (2 blast furnaces) and **modulation** of its value by **addition of Ground Granulated Blast Furnace Slags** (GGBFS)

CHARACTERIZATION OF GBFS

	Blast furnace	CaO %	SiO_2 %	Fe %	S %	Al_2O_3 %	MgO %	SS (<80µm) cm^2/g	F	α Coeff.	w %
Max	BF1+ BF2	43.84	38.14	0.45	1.21	12.43	7.39	2535	12.5	26	10.3
Min		39.89	35.59	0.01	0.56	10.40	5.78	1457	8	13	5.1
Max	BF1	43.60	38.14	0.34	1.21	12.43	7.16	2002	12.1	22	10.0
Min		39.89	35.98	0.01	0.56	10.78	5.78	1457	8	13	5.4
Max	BF2	43.84	38.11	0.45	1.03	11.69	7.39	2535	12.5	26	10.3
Min		40.07	35.59	0.06	0.56	10.40	6.23	1489	9	14	5.1
Average	BF1+BF2	42.02	37.15	0.25	0.89	11.25	6.77	1775	10.5	18.6	7.2
	BF1	42.07	37.16	0.22	0.90	11.38	6.64	1633	10.4	17.1	7.5
	BF2	41.96	37.15	0.27	0.88	11.13	6.89	1916	10.5	20.2	6.9
Standard deviation	BF1+BF2	0.82	0.49	0.08	0.10	0.36	0.29	227	0.7	3.0	1.1
	BF1	0.79	0.42	0.06	0.11	0.41	0.32	116	0.5	1.3	1.2
	BF2	0.73	0.55	0.10	0.09	0.33	0.26	245	0.9	3.5	0.8

- Chemical composition and friability (F) : regular
- Specific Surface (SS) of the fines particles : variable
- Granularity of all GBFS (fines content ~0.8%) : similar
- Correlation between SS and fines granularity : good

The **variation of the α** coefficient depends on the **specific surface** of the fines (granulation process)

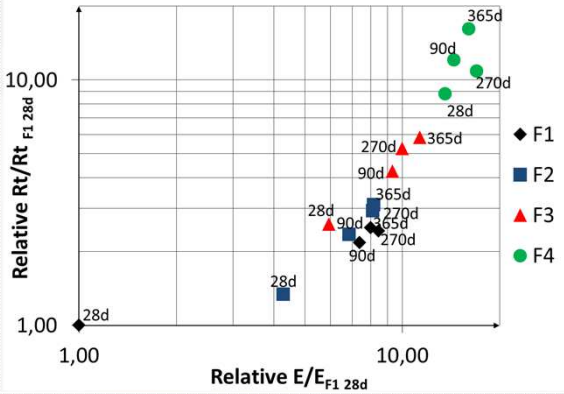
HYDRAULICALLY BOUND MIXTURES

Preparation : NF EN 13286-2 standard

Formulation of hydraulically bound mixtures				
	Formula 1	Formula 2	Formula 3	Formula 4
CBFS 0/22.4	80	80	80	80
GBFS	20	19	17.5	15
GGBFS	0	1	2.5	5

Determination of tensile strength Rtb (MPa) and elastic modulus E (MPa) : relative values

Rtb=f(E) (relative values)



- Highest increase of Rtb and E at 28 days
- High increase of Rtb and E for formula 3 (x 2) and for formula 4 (x 10 at short term)

Addition of 2.5% and 5% of GGBFS improve the hydraulic activity of hydraulically bound mixture

CONCLUSION

- Reactivity of the GBFS governed by α coefficient, whose variation is due to the specific surface of the fines
- Increase of the mechanical performances by addition of GGBFS to hydraulically bound mixtures
- The α coefficient is not relevant enough to evaluate the reactivity of hydraulically bound mixtures: quantity of fines in the mixture is not taken into account.