

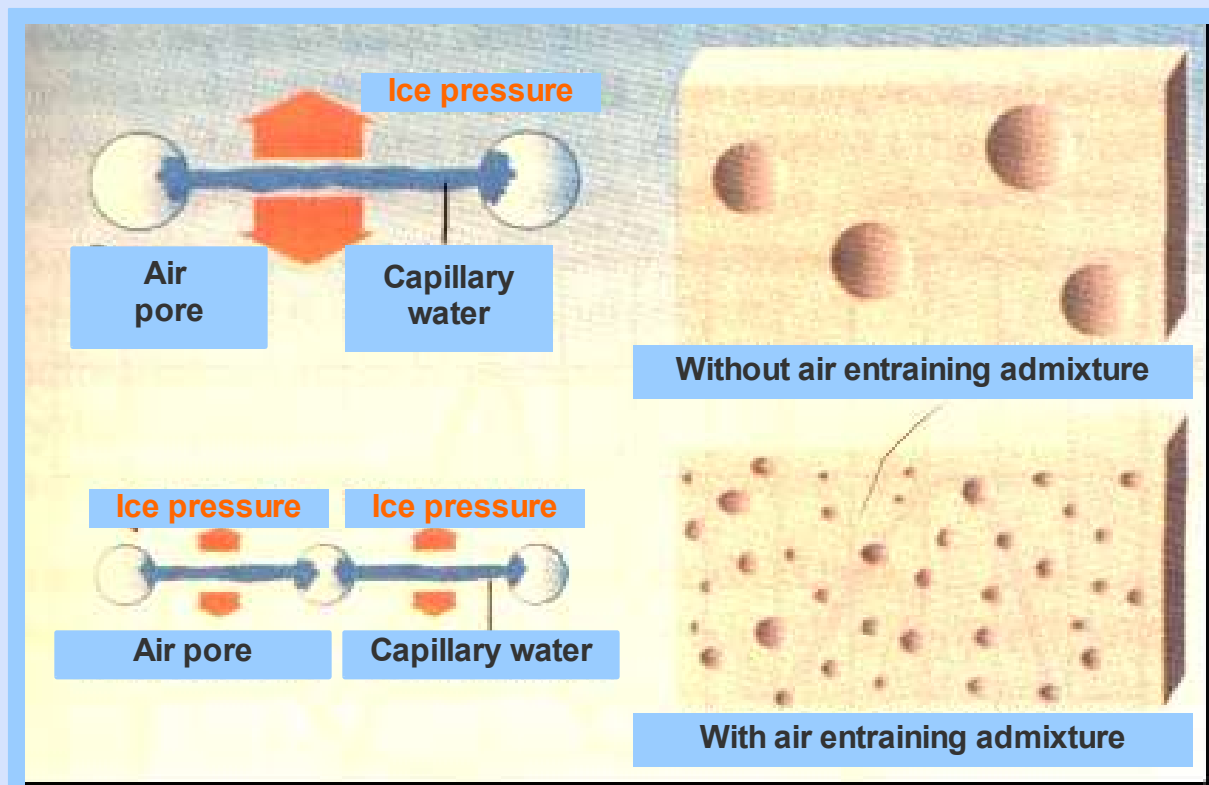
**13. Kolloquium und Workshop über
„Rheologie mineralischer Baustoffe“
FH Regensburg, 10. und 11.März 2004**

**INFLUENCE OF AIR ENTAINING AGENTS
ON RHEOLOGICAL PROPERTIES
OF SUPERPLASTICIZED MORTARS**

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Silesian University of Technology, Gliwice, Poland

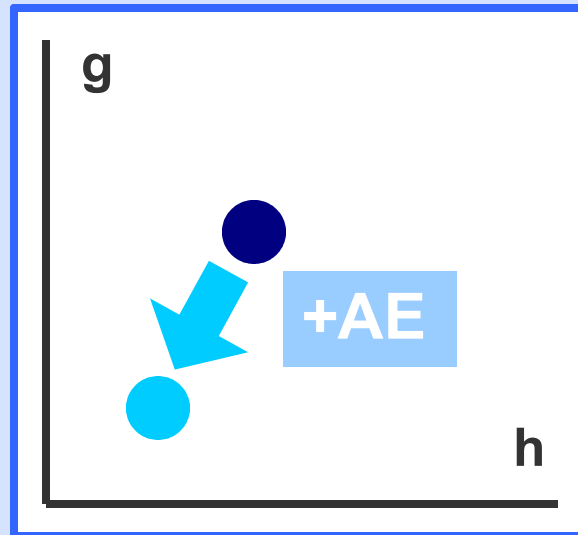
INTRODUCTION

Air entrainment - essential for durability of concrete.



INTRODUCTION

Air entrainment - changes the rheological properties of fresh concrete.

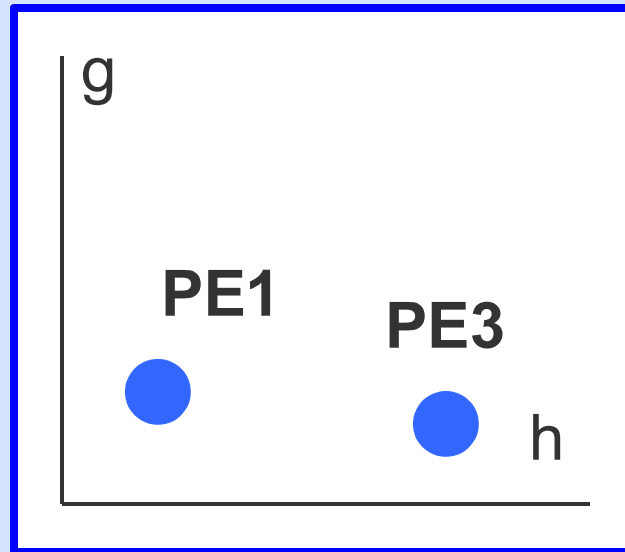


How AE admixtures influencing rheological properties of fresh HPC and SCC when different cement - SP - (FA) systems are used?

VARIABLES

Cement - 4 cements of different C_3A (2 & 12%)
and Na_2O_{eq} (0,3 & 1,1%) content

Superplasticizer - 2 SP's of PE type - 0,5% (2% C_3A)
- 3,0% (12% C_3A)



TESTING METHOD

Measurement of rheological properties:
rheometrical workability test (RWT)

On normal mortars
acc. PN EN 196-1:1996

Measurements were
performed
in conditions acc:
PN EN 196-1:1996
PN EN 934-2:1999.

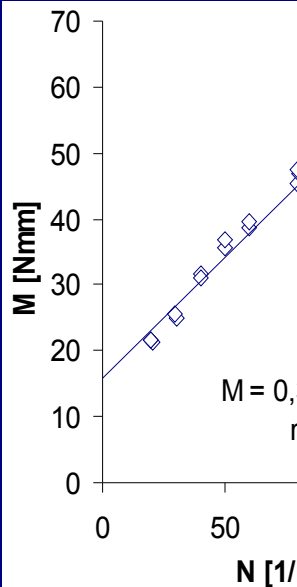


Viskomat PC

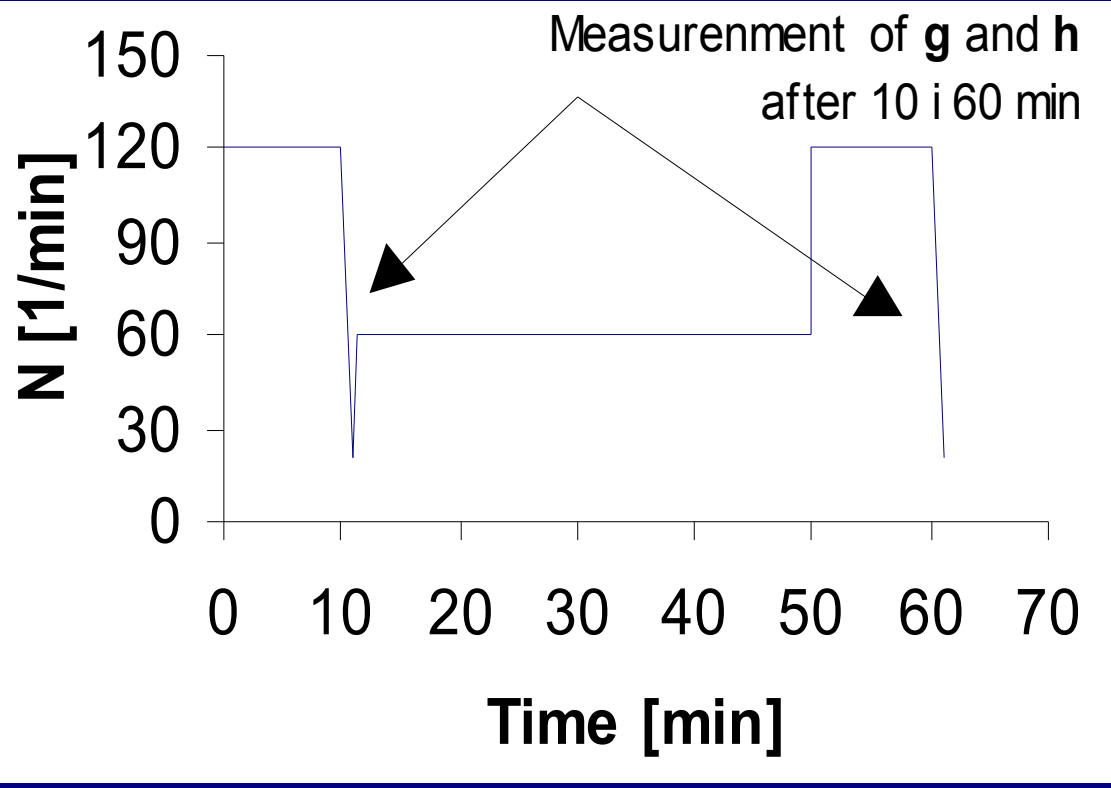
TESTING PROCEDURE

$$M = g + h N$$

g & h after 10

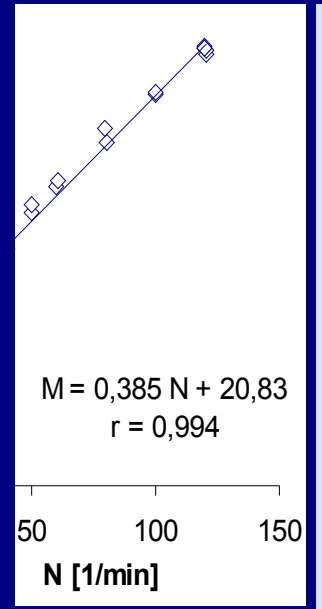


Measurement of g and h after 10 i 60 min

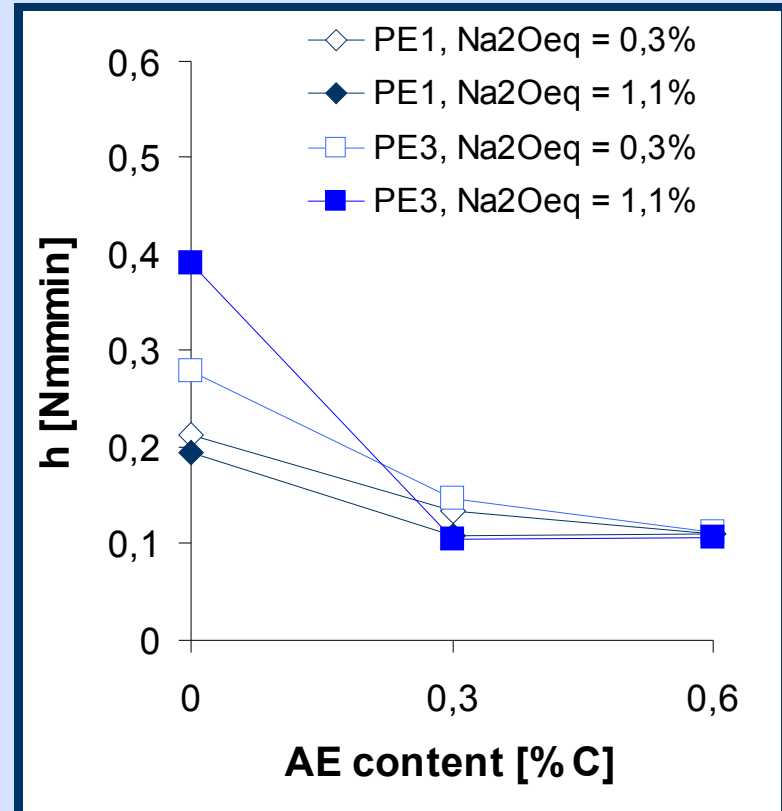
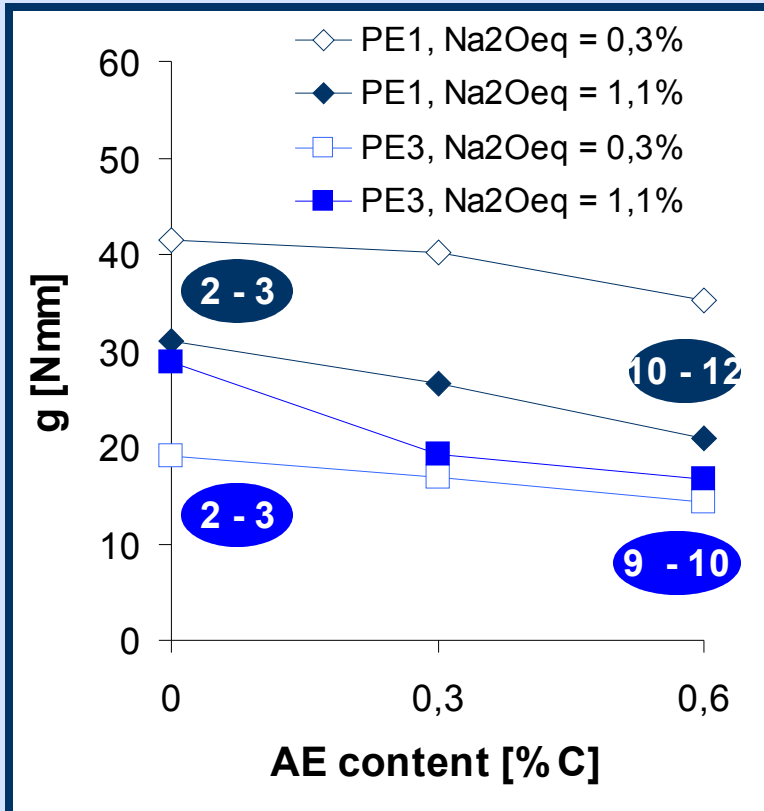


0 10 20 30 40 50 60 70
Time [min]

h after 60 min



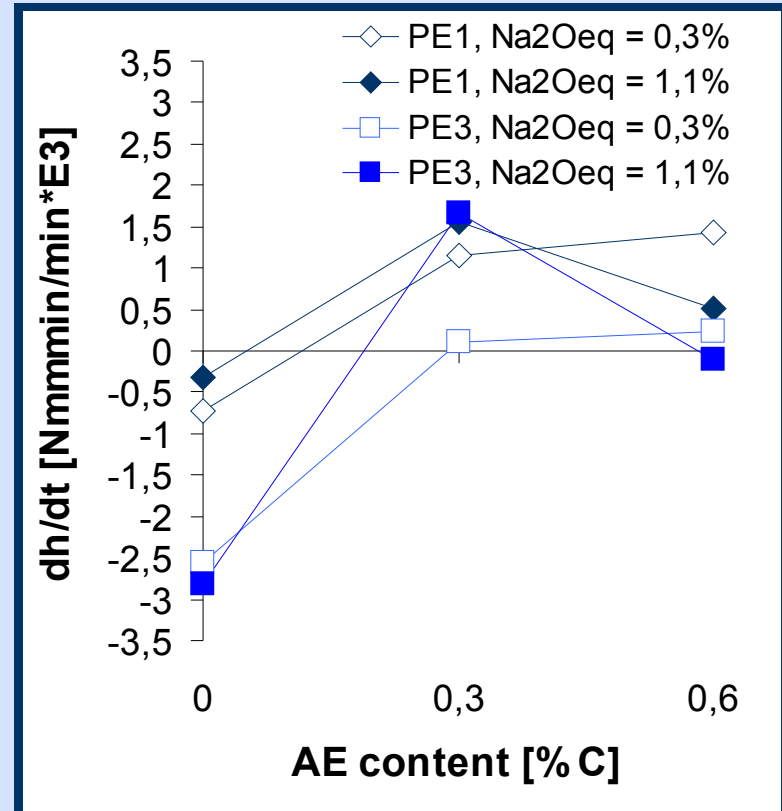
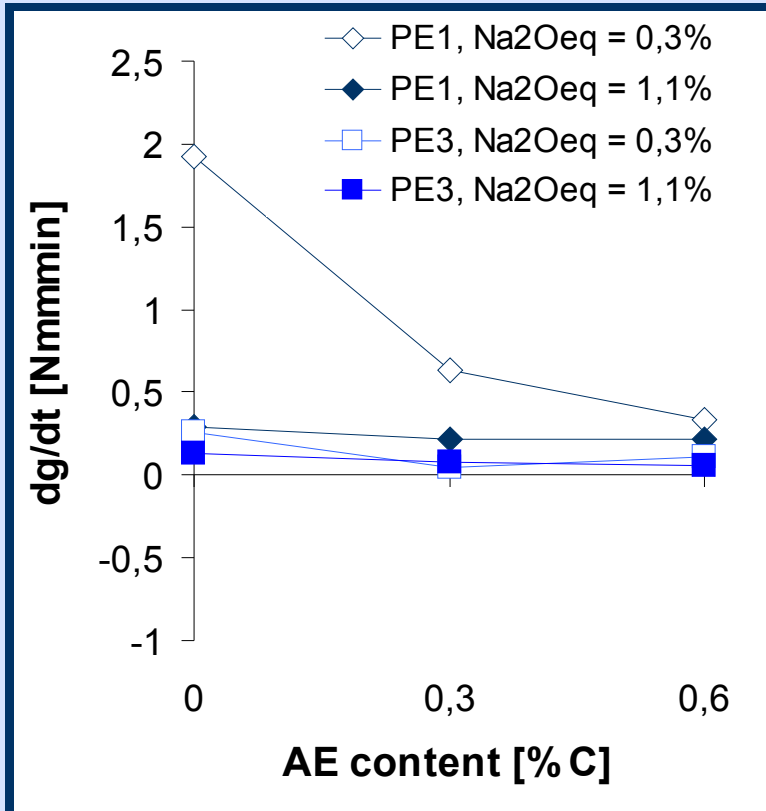
INFLUENCE OF AE ON CEMENT SUPERPLASTICIZED MORTARS



$C_3A = 2\%$; $S_{wt} = 370 \text{ m}^2/\text{kg}$
 AE1; SP PE 0,5%; $W/C = 0,40$

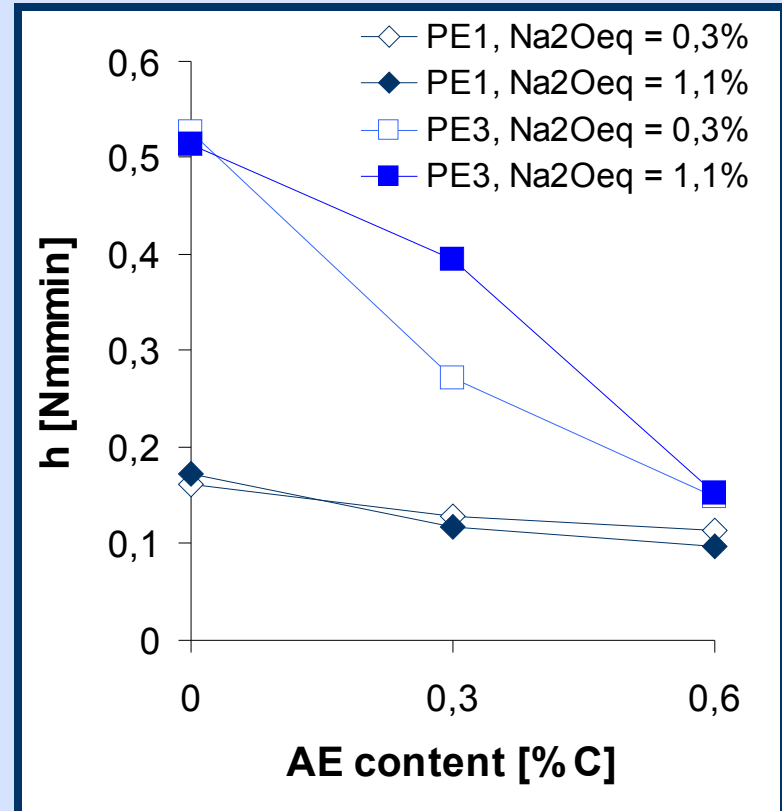
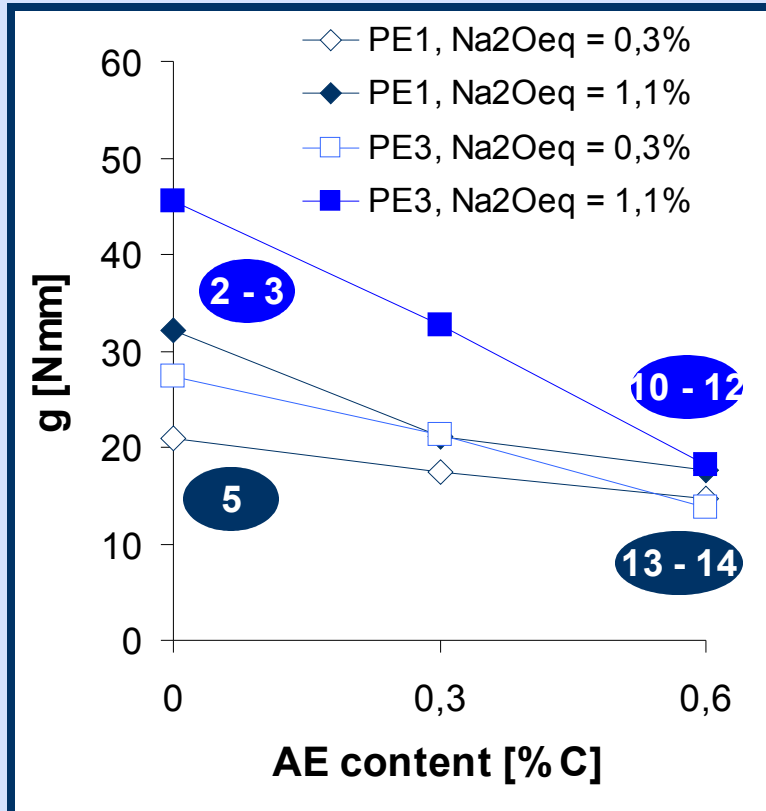
- air content [%]

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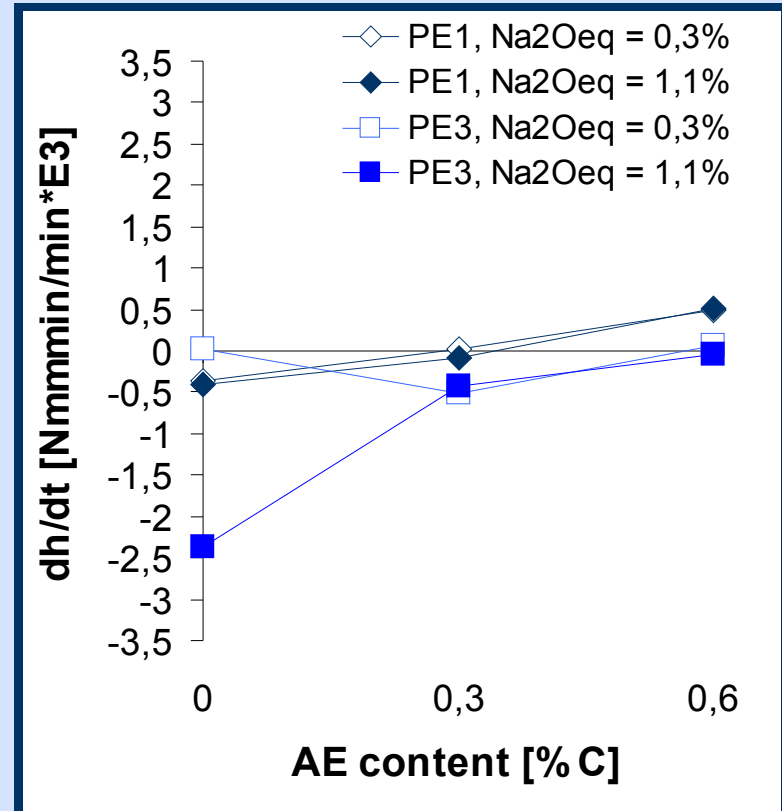
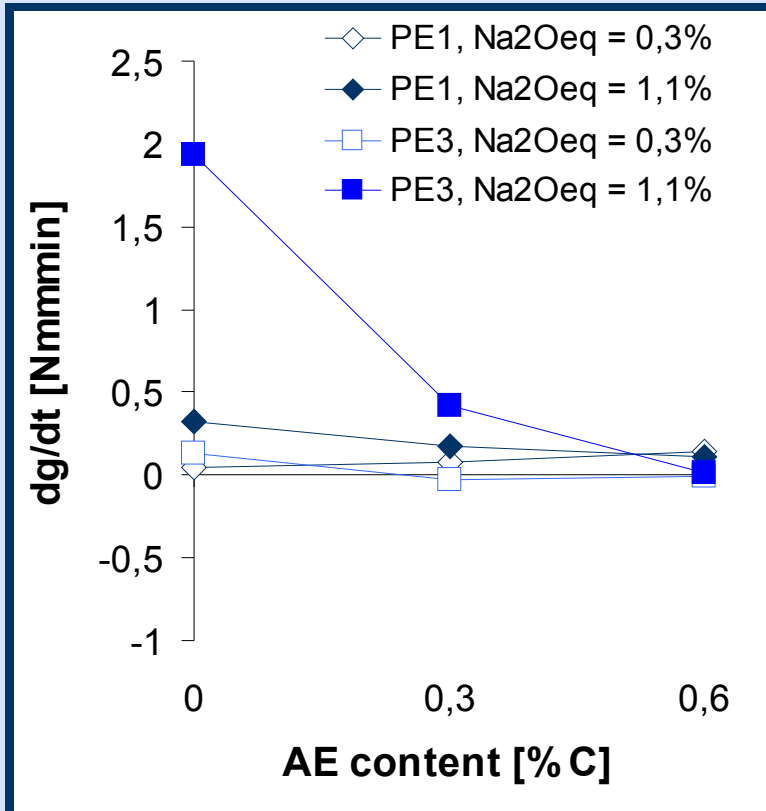
INFLUENCE OF AE ON CEMENT SUPERPLASTICIZED MORTARS



$C_3A = 12\%$; $S_{wt} = 370 \text{ m}^2/\text{kg}$
 AE1; SP PE 3%; $W/C = 0,40$

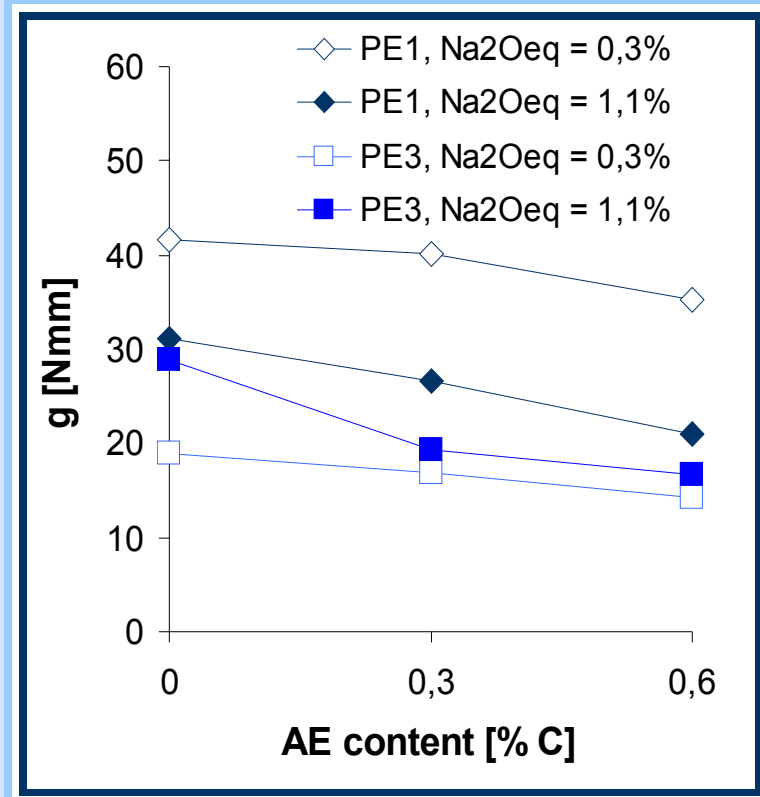
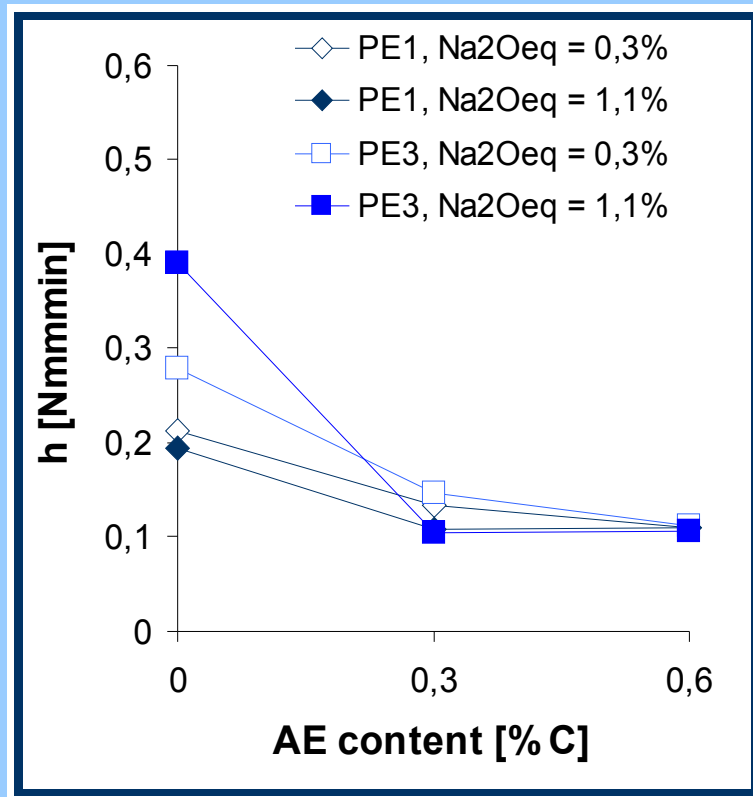
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INFLUENCE OF AE ON CEMENT SUPERPLASTICIZED MORTARS



C₃A = 12%; S_{wf} = 370 m²/kg
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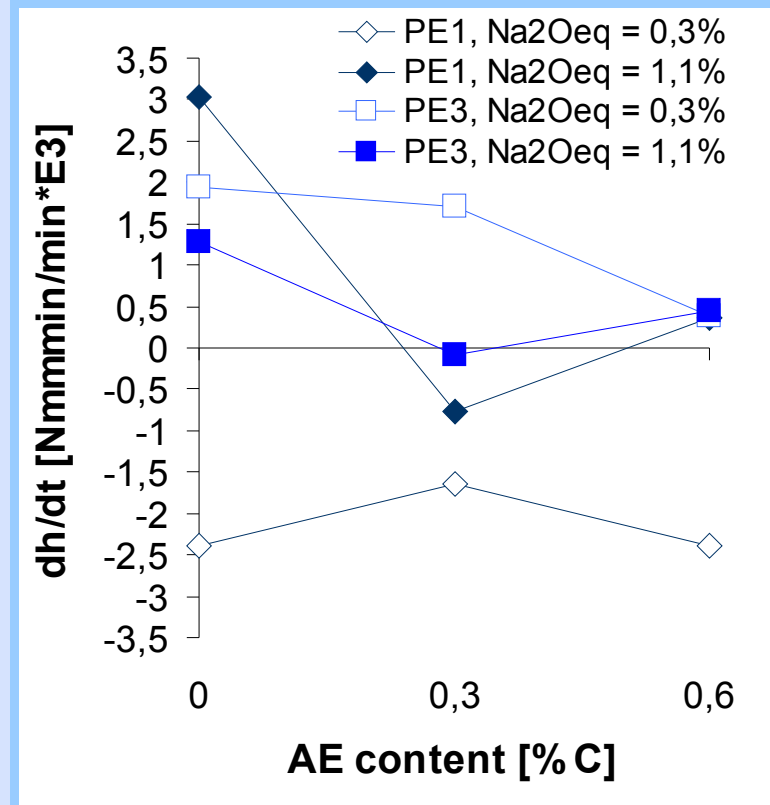
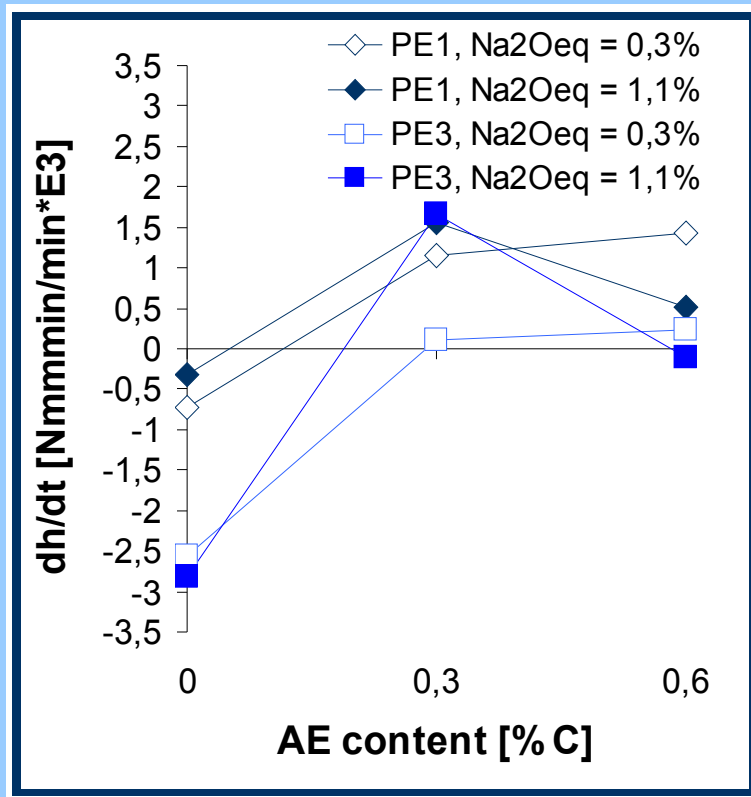
INFLUENCE OF AE ON CEMENT + FA SUPERPLASTICIZED MORTARS



**C₃A = 2%; S_{wf} = 370 m²/kg;
 FA = 20% as C replacement
 AE1; SP PE 0,5%; W/C = 0,40**

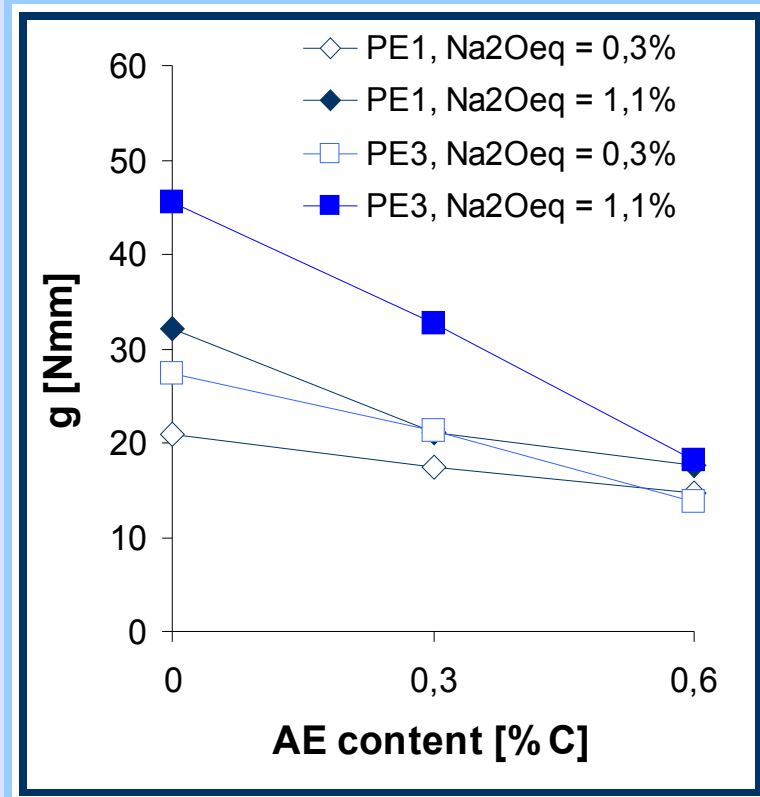
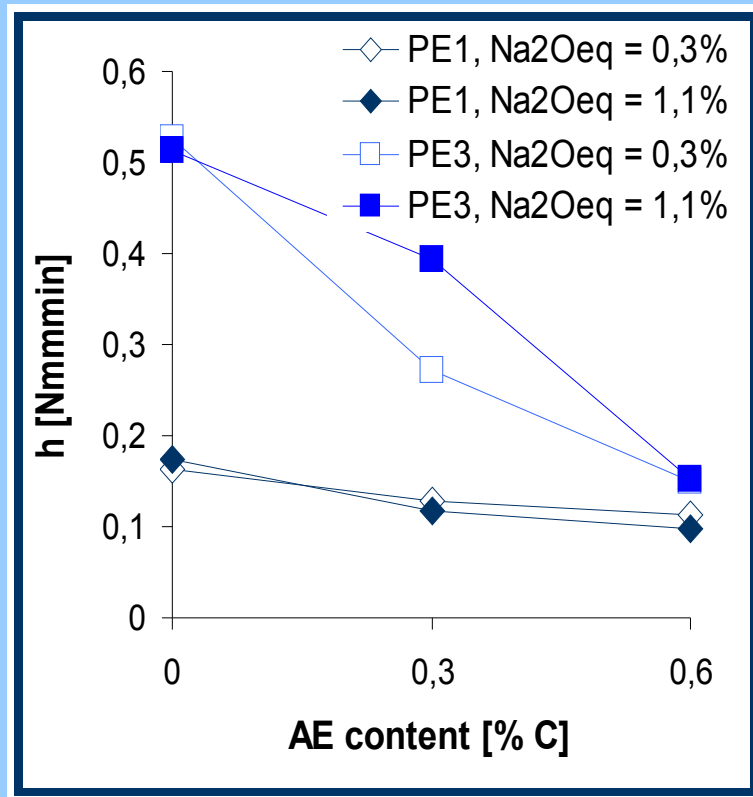
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INFLUENCE OF AE ON CEMENT + FA SUPERPLASTICIZED MORTARS



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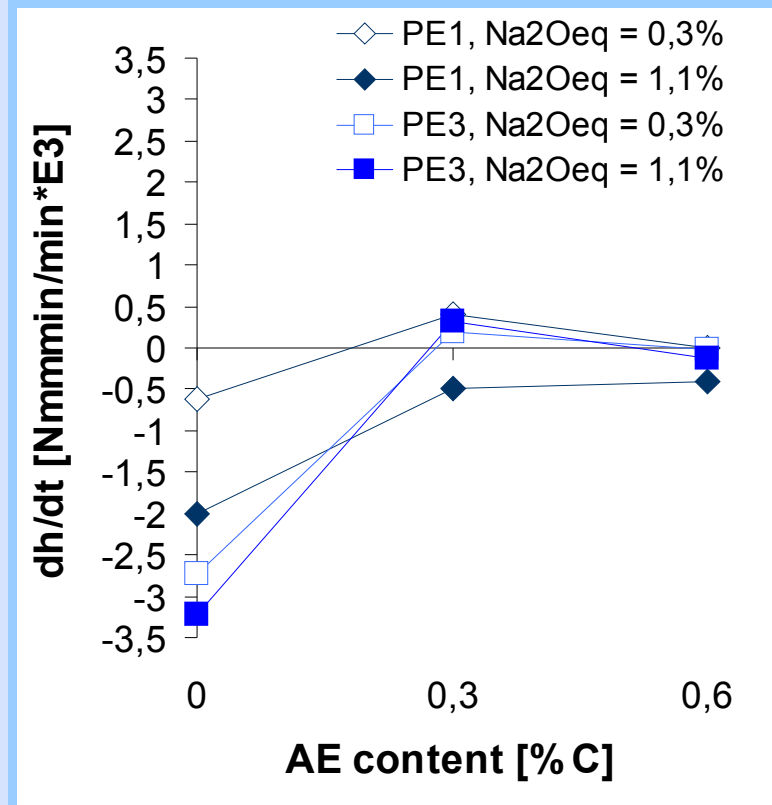
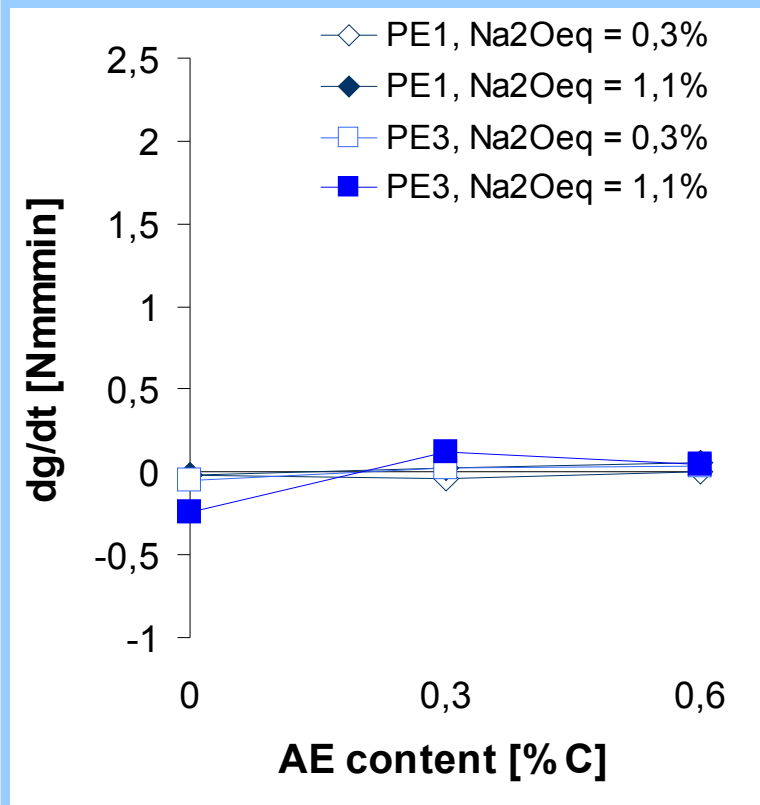
INFLUENCE OF AE ON CEMENT + FA SUPERPLASTICIZED MORTARS



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 FA = 20% as C replacement
 AE1; SP PE 3%; W/C = 0,40

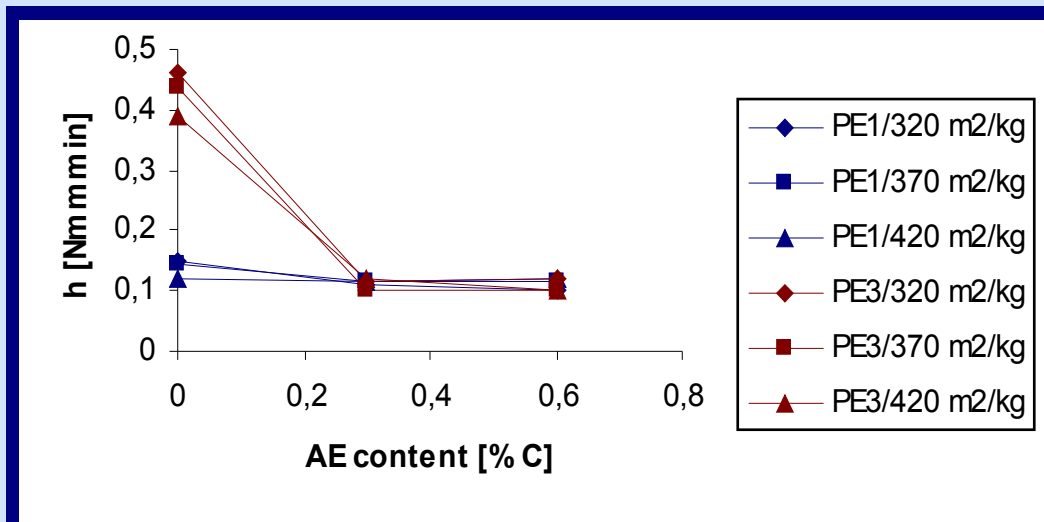
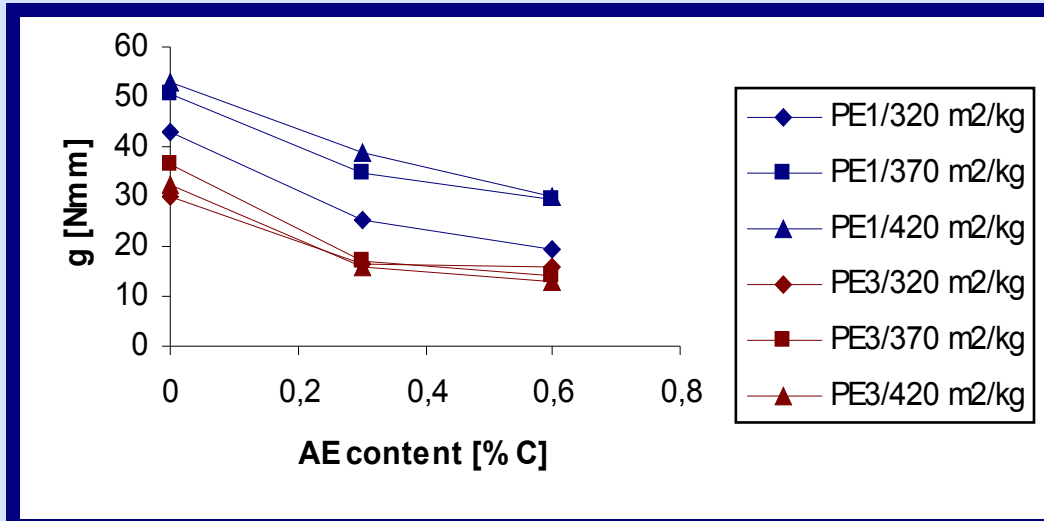
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INFLUENCE OF AE ON CEMENT + FA SUPERPLASTICIZED MORTARS



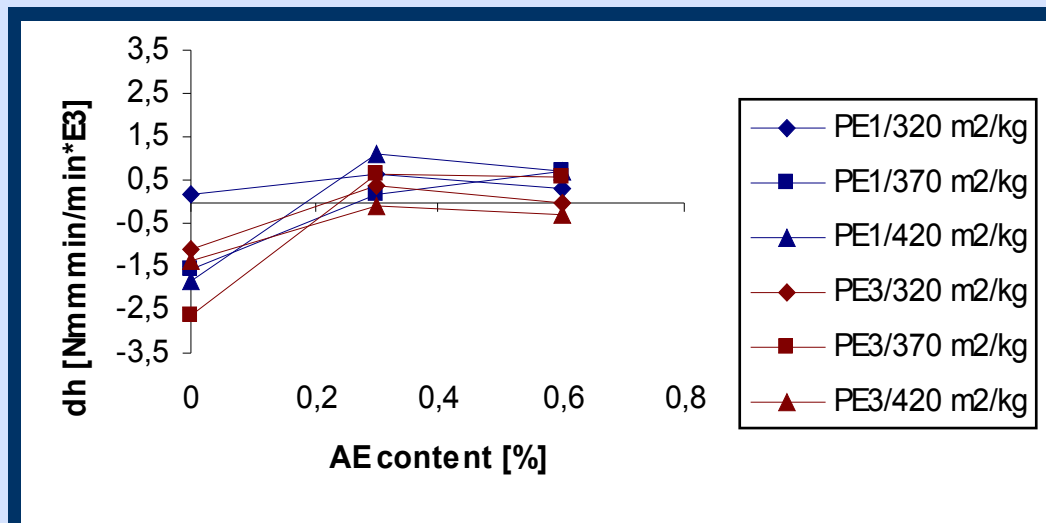
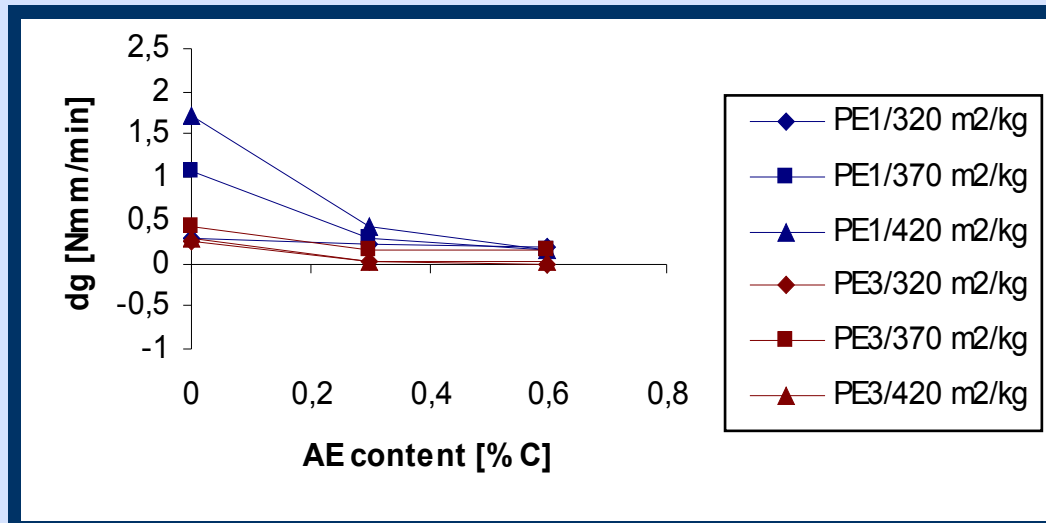
C₃A = 12%; S_{wf} = 370 m²/kg;
FA = 20% as C replacement
AE1; SP PE 3%; W/C = 0,40

INFLUENCE OF AE ON SUPERPLASTICIZED MORTARS WITH DIFFERENT GRADE CEMENTS



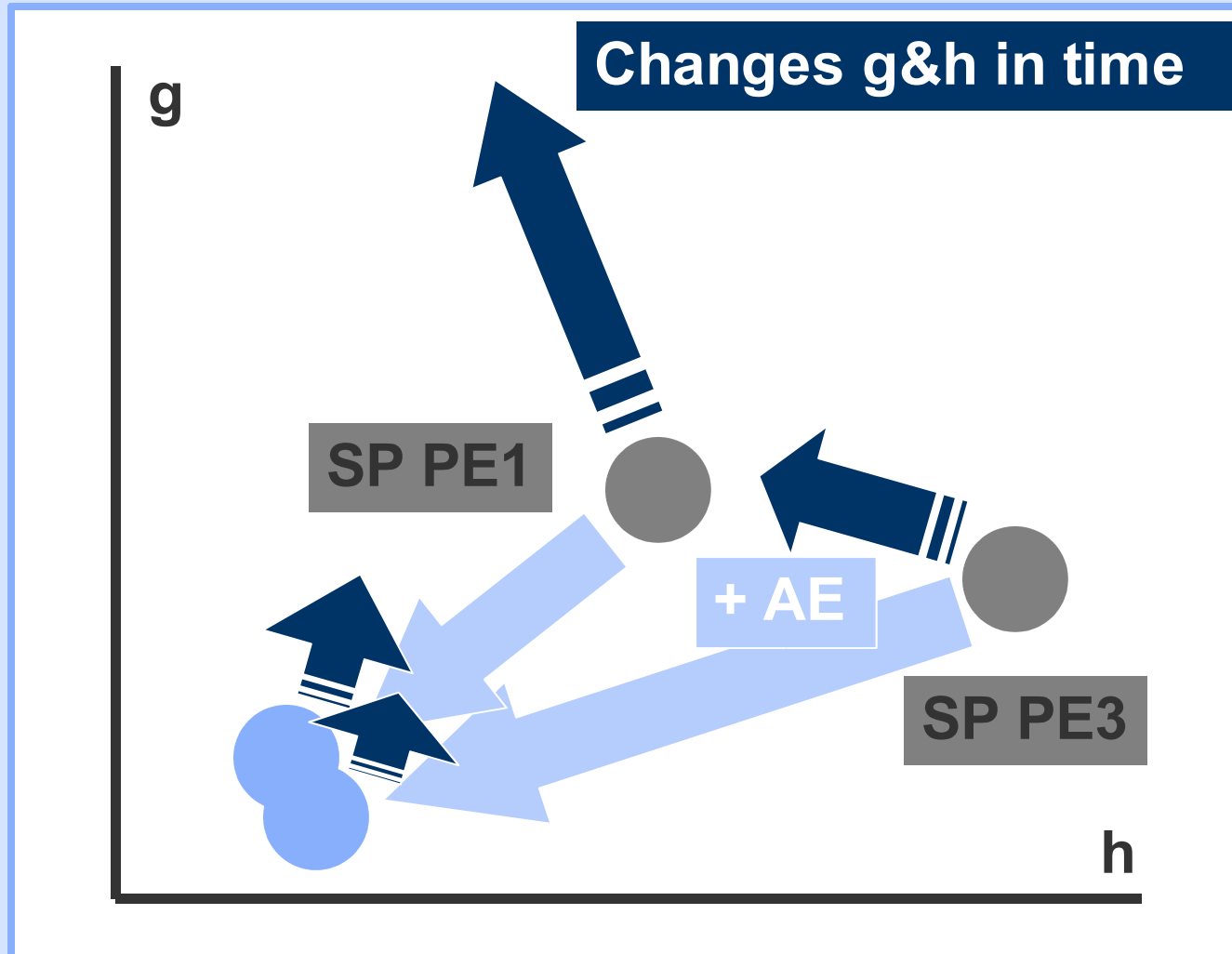
AE1; $C_3A = 7\%$;
SP PE 1%;
W/C = 0,40

INFLUENCE OF AE ON SUPERPLASTICIZED MORTARS WITH DIFFERENT GRADE CEMENTS

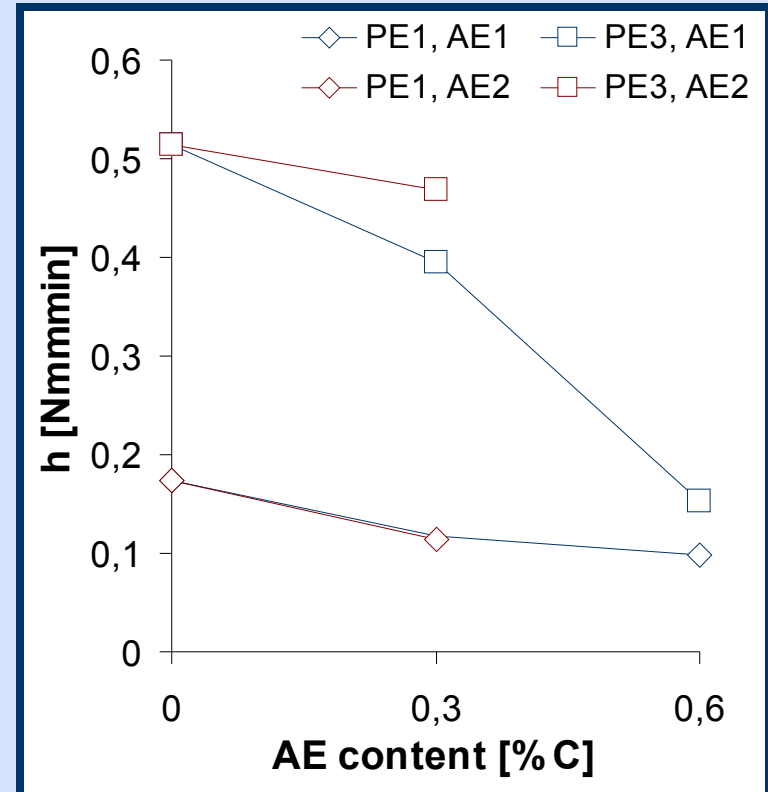
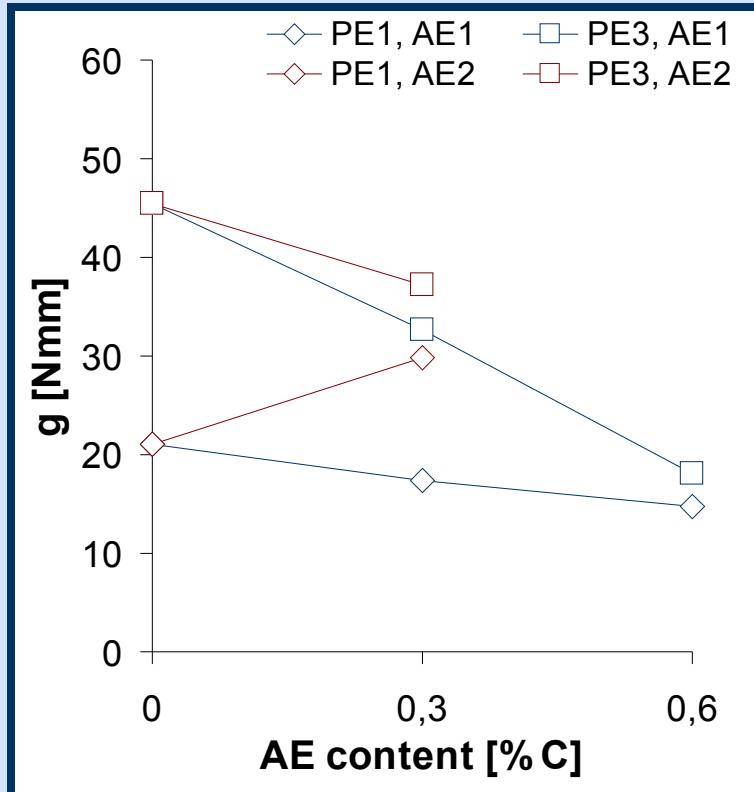


AE1; $C_3A = 7\%$;
 SP PE 1%;
 W/C = 0,40

INFLUENCE OF AE - GENERAL TRENDS

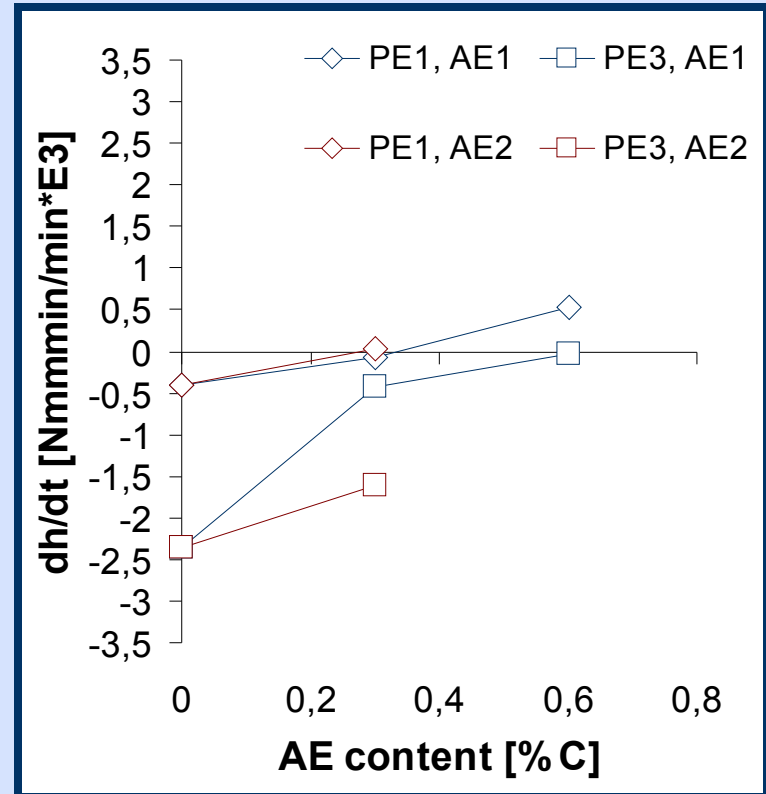
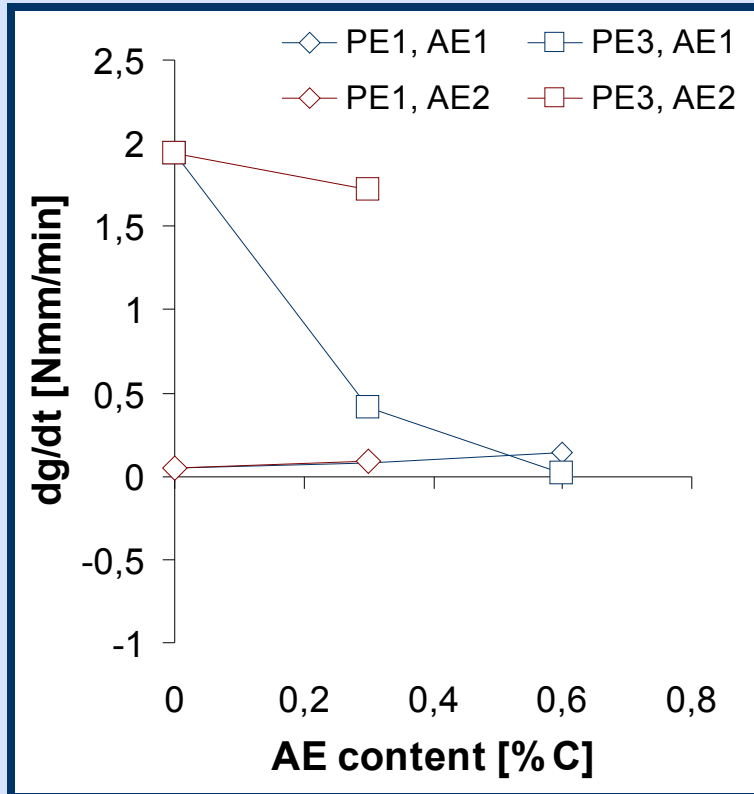


INFLUENCE OF AE TYPE



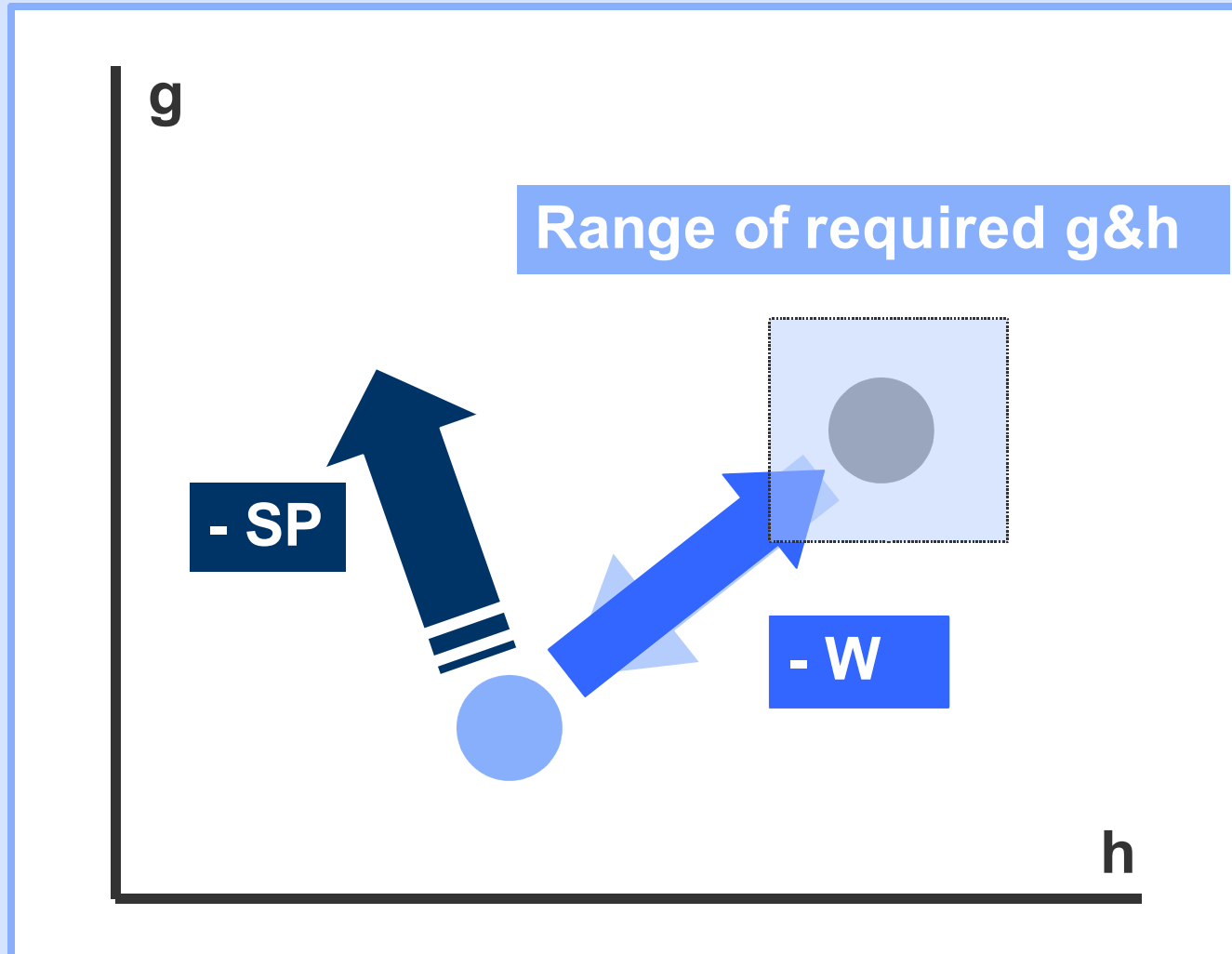
$C_3A = 12\%$; $S_{wt} = 370 \text{ m}^2/\text{kg}$;
AE1, AE2; SP PE 3%; $W/C = 0,40$

INFLUENCE OF AE TYPE

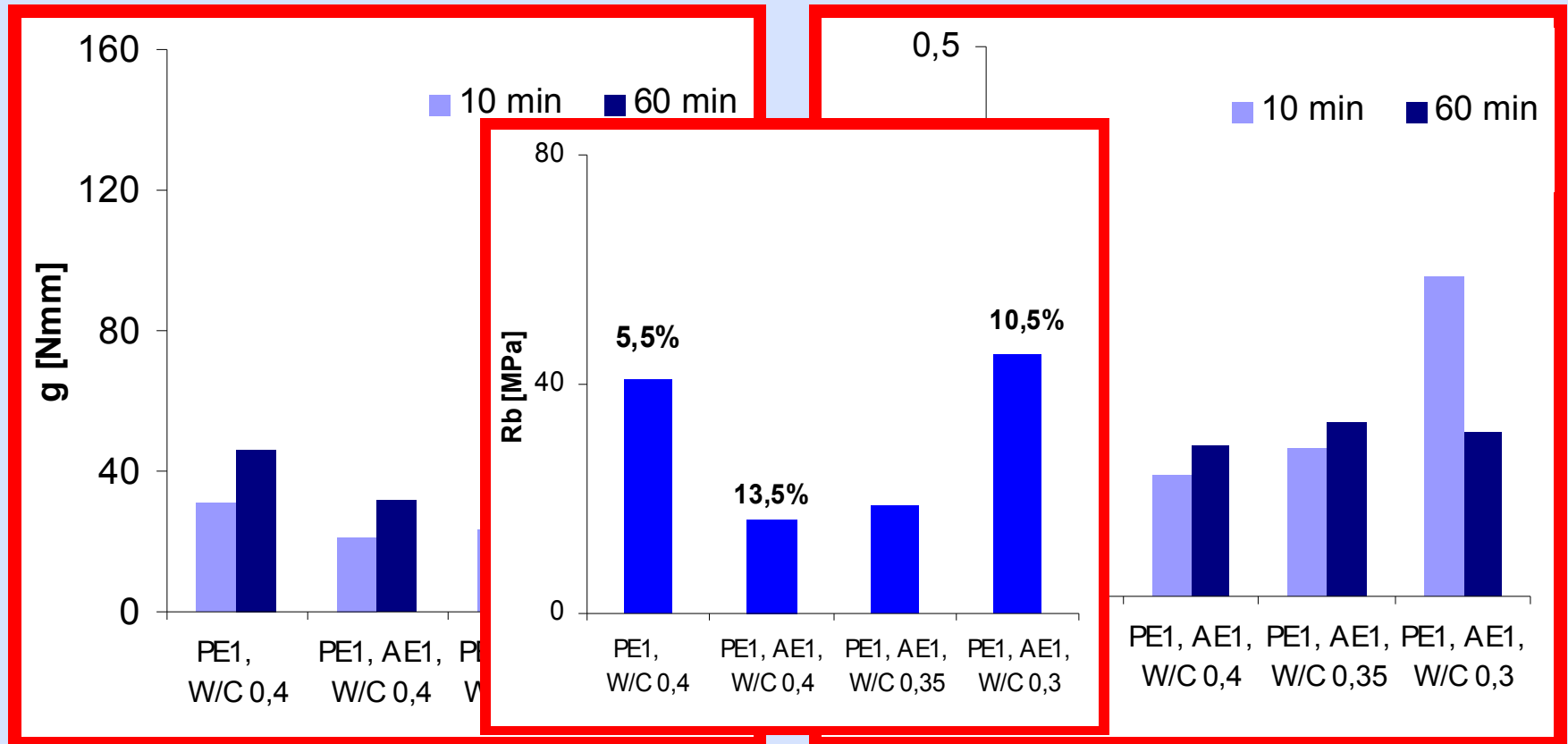


$C_3A = 12\%$; $S_{wt} = 370 \text{ m}^2/\text{kg}$;
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CORRECTION OF AE INFLUENCE

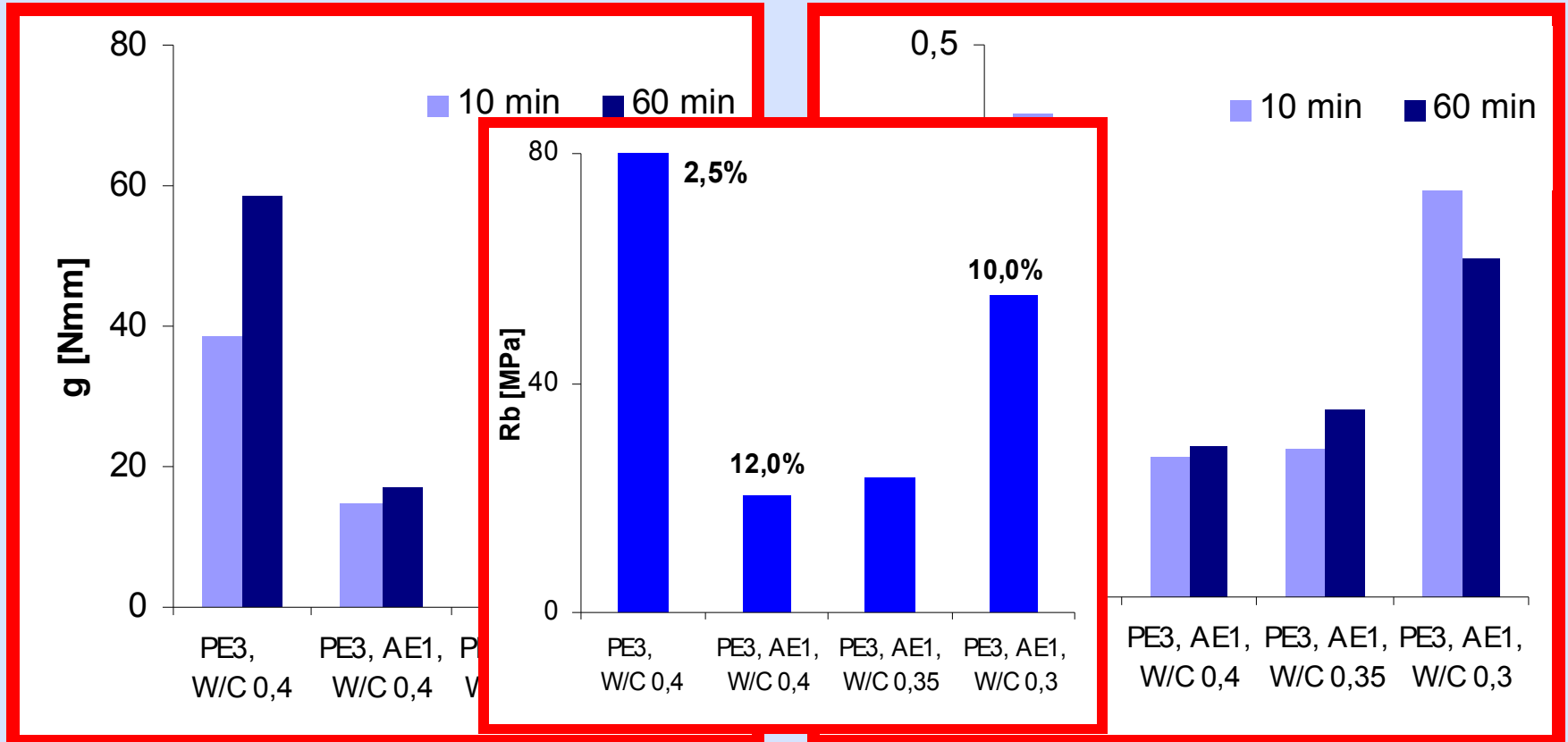


CORRECTION OF AE INFLUENCE



$C_3A = 2\%$; $S_{wt} = 320 \text{ m}^2/\text{kg}$;
 $AE1 = 0,6\%$; $SP \text{ PE1 } 0,5\%$;

CORRECTION OF AE INFLUENCE



$C_3A = 7\%$; $S_{wt} = 420 \text{ m}^2/\text{kg}$;
 $AE1 = 0,6\%$; $SP \text{ PE3 } 1\%$;

SUMMARY

- ➔ In the paper basic effects of AE agent on the rheological properties of fresh concretes were presented.
- ➔ Effective method of correction of AE influence on rheological properties was proposed.
- ➔ Effect of AE agent on workability should be studied on the stage of choosing compatible cement - SP system.
- ➔ Using RWT it is possible to check AE influence on rheological properties of concrete and work out the procedure of correction of workability of air entrained concrete.