Eleventh International Conference on Superplasticizers and Other Chemical Admixtures in Concrete

ACI SP 302

Ottawa, Ontario, Canada 10-13 July 2015

Editors:

V. Mohan Malhotra Terence C. Holland Pawan R. Gupta

ISBN: 978-1-5108-1978-8

Printed from e-media with permission by:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright[©] (2015) by American Concrete Institute All rights reserved.

Printed by Curran Associates, Inc. (2016)

For permission requests, please contact American Concrete Institute at the address below.

American Concrete Institute 38800 Country Club Drive Farmington Hills, MI 48333 USA

Phone: (248) 848-3700 Fax: (248) 848-3701

BKStore@concrete.org

Additional copies of this publication are available from:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571 USA Phone: 845-758-0400 Fax: 845-758-2634 Email: curran@proceedings.com Web: www.proceedings.com

Contents

Preface	3	SP-302-04 53
		New Additive to Enhance the Slump
SP-302-01	11	Retention
Effect of Clinker Grinding Aids on		by David Platel, Jean-Marc Suau,
Static Yield Stress of Cement Pas	tes	Clement Chosson, and Yves Matter
by Joseph J. Assaad and Salim E.		INTRODUCTION 53
Asseily		RESEARCH SIGNIFICANCE 54
INTRODUCTION	11	EXPERIMENTAL AND ANALYTICAL
RESEARCH SIGNIFICANCE	12	INVESTIGATIONS 54
EXPERIMENTAL INVESTIGATION	12	EXPERIMENTAL RESULTS AND
TEST RESULTS AND DISCUSSION	15	DISCUSSION 56
CONCLUSIONS	21	FURTHER RESEARCH 59
		CONCLUSIONS 60
SP-302-02	25	
A ¹³ C NMR Spectroscopic Study		SP-302-05 63
on the Reparation of Acid and		Synthesis of a Novel
Ester Groups in MPEG Type		Superplasticizer Prepared from
PCEs Prepared via Radical		Brown Coal
Copolymerization and Grafting		by Manuel IIg and Johann Plank
Techniques		INTRODUCTION 63
by Julia Pickelmann, Huigun Li, Rob	bert	RESEARCH SIGNIFICANCE 64
Baumann, and Johann Plank		EXPERIMENTAL PROCEDURE 64
INTRODUCTION	25	EXPERIMENTAL RESULTS AND
RESEARCH SIGNIFICANCE	26	DISCUSSION 68
EXPERIMENTAL PROCEDURES	27	CONCLUSIONS 74
RESULTS AND DISCUSSION	29	
CONCLUSION	34	SP-302-06 77
		Influence of Superplasticizers on
SP-302-03	39	the Flocculation Degree of Cement
Effects of Particle Volume Fractio	n	Suspensions
and Size on Polysaccharide		by Lucia Ferrari and Pascal
Stabilizing Agents		Boustingorry
by Wolfram Schmidt, Sarah Peters,		INTRODUCTION 77
and Hans-Carsten Kühne		RESEARCH SIGNIFICANCE 78
INTRODUCTION	39	EXPERIMENTAL PROCEDURES 78
RESEARCH SIGNIFICANCE	41	ANALYTICAL INVESTIGATION 80
EXPERIMENTAL INVESTIGATION	41	COMPARISON OF PREDICTIONS AND
EXPERIMENTAL RESULTS A	ND	EXPERIMENTAL RESULTS 81
DISCUSSION	44	EXPERIMENTAL RESULTS AND
SUMMARY AND CONCLUSIONS	50	DISCUSSION 81
	-	FURTHER RESEARCH 87
		CONCLUSIONS 88

SP-302-07	93	EXPERIME
Influence of Temperature and	•••	RESULTS
Retarder on Superplasticizer		DISCUSSIC
Performance		CONCLUSI
by Karen Luke and Adrian Torres		CONCLOSE
INTRODUCTION	93	SP-302-11
RESEARCH SIGNIFICANCE	94	Puttina Co
EXPERIMENTAL PROCEDURE	95	Waking It l
EXPERIMENTAL RESULTS	AND	Admixture
DISCUSSION	97	by L. Reiter
SUMMARY AND CONCLUSIONS	109	and R.J. Fla
		INTRODUC
SP-302-08	113	RESEARCH
Properties of a New Type of		EXPERIME
Polycarboxylate Admixture for		EXPERIME
Concrete Using High Volume Bl	last	DISCUSSIC
Furnace Slag Cement		CONCLUSI
by Shinji Tamaki, Kazuhide Saito,		
Kazuhisa Okada, Daiki Atarashi, a	and	SP-302-12
Etsuo Sakai		A Simplifie
INTRODUCTION	113	PCEs Invo
RESEARCH SIGNIFICANCE	114	by Lei Lei a
EXPERIMENTAL PROCEDURE	114	INTRODUC
EXPERIMENTAL RESULTS	AND	RESEARCH
DISCUSSION	116	EXPERIME
CONCLUSIONS	123	EXPERIME
		DISCUSSIC
SP-302-09	125	CONCLUSI
Synthesis and Properties of Hig	Jh	
Solid-Content Polycarboxylate		SP-302-13
Superplasticizer		Impact of S
by Yongwei Wang, Liya Wang,		Blended C
Yongsheng Liu, and Zepeng Chu		Effectivene
INTRODUCTION	125	by Ahmad I
RESEARCH SIGNIFICANCE	126	INTRODUC
EXPERIMENTAL INVESTIGATION	N 126	RESEARCH
EXPERIMENTAL RESULTS	AND	EXPERIME
DISCUSSION	128	EXPERIME
CONCLUSIONS	131	DISCUSSIC
		CONCLUSI
SP-302-10	133	
Mastering Flow Loss in		SP-302-14
Superplasticized Cementitious		Preparatio
Systems		of Star-Sha
by S. Mantellato, O. Mehmeti, I. (Coni	Supernlast

by S. Mantellato, Q. Mehmeti, L. Co	enı,
M. Palacios, and R.J. Flatt	
INTRODUCTION	133
RESEARCH SIGNIFICANCE	134

EXPERIMENTAL PROCEDURE	134
RESULTS	136
DISCUSSION	140
CONCLUSIONS	142

145

55 58 58

169

Putting Concrete to Sleep and Waking It Up with Chemical

Admixtures

by L. Reiter, M. Palacios, T. Wangler,		
and R.J. Flatt		
INTRODUCTION	145	
RESEARCH SIGNIFICANCE	146	
EXPERIMENTAL INVESTIGATION	146	
EXPERIMENTAL RESULTS	147	
DISCUSSION	151	
CONCLUSIONS	152	

SP-302-12 155

```
A Simplified Preparation Method for
PCEs Involving Macroradicals
```

by Lei Lei and Johann Plank	
INTRODUCTION	1
RESEARCH SIGNIFICANCE	1
EXPERIMENTAL INVESTIGATION	1

EXPERIMENTAL	RESULTS	AND
DISCUSSION		162
CONCLUSIONS		165

```
SP-302-13
mpact of Slags Contained in
Blended Cement on Dispersing
Effectiveness of PCEs
v Ahmad Habbaba and Johann Plank
```

INTRODUCTION		169
RESEARCH SIGNI	FICANCE	170
EXPERIMENTAL I	NVESTIGATION	v 171
EXPERIMENTAL	RESULTS	AND
DISCUSSION		173
CONCLUSIONS		178

```
SP-302-14
                                183
Preparation and Characterization
of Star-Shaped Polycarboxylate
Superplasticizer
```

by Xiao Liu, Ziming Wang, Jie Zhu, Ming Zhao, Wei Liu, and Dongjie Yin INTRODUCTION 183

RESEARCH SIGN	NIFICANCE	184
EXPERIMENTAL	INVESTIGATION	184
EXPERIMENTAL	RESULTS	AND
DISCUSSION		187
CONCLUSIONS		195

SP-302-15 199

Influence of Diester Content in Macromonomers on Performance of MPEG-Based PCEs

by Johannes Paas,	Maike W. Mü	ller,
and Johann Plank		
INTRODUCTION		199
RESEARCH SIGNIF	ICANCE	202
EXPERIMENTAL IN	VESTIGATIO	N 202
EXPERIMENTAL	RESULTS	AND
DISCUSSION		203
CONCLUSIONS		209

SP-302-16 211

Evidences about the Interactions between Grinding Aids and Cement Particles Surface

by Valerio Antonio Paternò, Sara		
Ottoboni, Marco Goisis, and Paolo		
Gronchi		
INTRODUCTION	211	
RESEARCH SIGNIFANCE	212	
MATERIALS AND METHODS	212	
DISCUSSION	217	
FURTHER RESEARCH	223	
CONCLUSION	223	

SP-302-17	227
5P-302-17	227

The Influence of C₃A on the Dissolution Kinetics of Alite/ Gypsum Mixtures in the Presence of PCEs

by Giorgio Ferrari, Vincenzo Russo, Massimo Dragoni, Gilberto Artioli, Maria Chiara Dalconi, Michele Secco, Leonardo Tamborrino, and Luca Valentini INTRODUCTION 227 RESEARCH SIGNIFICANCE 228 MATERIALS AND METHODS 229 RESULTS AND DISCUSSION 231 CONCLUSIONS 238 Preparation and Mechanism Study of Slow-Release Polycarboxylate Superplasticizers by Jinzhi Liu, Jiaping Liu, Yong Yang, Dongliang Zhou, and Qianping Ran **INTRODUCTION** 243 **EXPERIMENTAL INVESTIGATION 244 RESULTS AND DISCUSSION** 246 CONCLUSIONS 250 SP-302-19 253 Effect of Pore Solution **Composition on Zeta Potential and** Superplasticizer Adsorption by Dirk Lowke and Christoph Gehlen **INTRODUCTION** 253 ELECTRIC DOUBLE LAYER AND ZETA POTENTIAL 254 MATERIALS AND METHODS 256 **RESULTS AND DISCUSSION** 257

SP-302-20

CONCLUSIONS

SP-302-18

265

263

243

Optimization of the Structural Parameters and Properties of PCE Based on the Length of Grafted Side

Chain

SP-302-21

by Zi-Ming Wang, Zi-Chen Lu, and Xiao Liu INTRODUCTION 265 RESEARCH SIGNIFICANCE 266 EXPERIMENTAL INVESTIGATION 266 RESULTS AND DISCUSSION 267 CONCLUSIONS 275

279

Blended Antifreezing Admixture with Extreme Freezing-Point

by Anatoly I. Vov	k	
INTRODUCTION		279
RESEARCH SIGN	IIFICANCE	280
EXPERIMENTAL	INVESTIGATION	281
EXPERIMENTAL	RESULTS	AND
DISCUSSION		281
CONCLUSIONS		286

SP-302-22	289
Effect of Expansive Agents and	
Shrinkage Reducing Admixtures	s on
the Performance of Fiber-Reinfo	rced
Mortars	
by M. Collepardi, V Corinaldesi, S.	
Monosi, and A. Nardinocchi	
INTRODUCTION	289
MATERIALS AND METHODS	290
RESULTS	291
CONCLUSIONS	295
SP-302-23	299
Interactions between Cements v	vith
Calcined Clay and Superplastici	zers
by Jens Herrmann and Jörg Ricke	rt
INTRODUCTION	299

INTRODUCTION	299
RESEARCH SIGNIFICANCE	300
EXPERIMENTAL PROCEDURE	300
EXPERIMENTAL RESULTS	AND
DISCUSSION	305
SUMMARY AND CONCLUSIONS	310

SP-302-2	24
Modifica	tion of Fresh State
Propertie	es of Portland Cement-
Based M	ortars by Guar Gum
Derivativ	/es
by Alexa	ndre Govin, Marie-Claude
Bartholin	, and Philippe Grosseau

INTRODUCTION	315
RESEARCH SIGNIFICANCE	316
MATERIALS AND METHODS	316
EXPERIMENTAL RESULTS	320
DISCUSSION	324
CONCLUSIONS	328

SP-302-25 333 Interaction of Polycarboxylatebased Superplasticizer/Poly(vinyl alcohol) with Bentonite and Its Application in Mortar with Claybearing Aggregates by Weishan Wang, Zuiliang Deng, Zhongjun Feng, Lefeng Fu, and Baicun Zheng INTRODUCTION 333

MATERIALS AND METODS 3	34

RESULTS AND DISCUSSIONS	336
CONCLUSION	344

SP-302-26

Effect of the Stereochemistry of Polyols on the Hydration of Cement: Influence of Aluminate and Sulfate Phases

349

371

by Camille Nalet and André Nonat **INTRODUCTION** 349 **RESEARCH SIGNIFICANCE** 350 EXPERIMENTAL PROCEDURE 350 **RESULTS AND DISCUSSIONS** 351 FURTHER RESEARCH 357 CONCLUSIONS 357

SP-302-27 359

A New Accelerator Approach for Improved Strength Development

by Franz Wombacher, Christian Bürge, Emmanuel Gallucci, Patrick Juilland, and Gilbert Mäder INTRODUCTION 359 RESEARCH SIGNIFICANCE 360 EXPERIMENTAL PROCEDURE 360 EXPERIMENTAL RESULTS AND DISCUSSION 362 CONCLUSIONS 367

SP-302-28 371

- **Sorption Kinetics of Superabsorbent**
- **Polymers in Cement Pastes**
- **Quantified by Neutron Radiography**
- by Christof Schroefl and Viktor

Mechtcherine INTRODUCTION

315

5

RESEARCH SIGNIFICANCE		372
EXPERIMENTAL IN	VESTIGATIO	N 372
EXPERIMENTAL	RESULTS	AND
DISCUSSION		376
SUMMARY AND CO	ONCLUSIONS	381

SP-302-29	387	EXPERIME
Study on the Rheology of Fly A	sh	DISCUSSIC
Versus Calcined Marl Blended		CONCLUS
Cements with Polycarboxylate-		
Based Superplasticizers		SP-302-33
by Serina Ng and Harald Justnes		Cement Re
INTRODUCTION	387	Sodium G
RESEARCH SIGNIFICANCE	388	by Daiki At
EXPERIMENTS AND METHODS	388	Yuya Yoda
RESULTS AND DISCUSSION	390	Etsuo Saka
CONCLUSIONS	398	INTRODUC
		RESEARCH
SP-302-30	401	EXPERIME
A Study on the Cement		EXPERIME
Compatibility of PCE		DISCUSSIC
Superplasticizers		CONCLUS
by A. Lange and J. Plank		
INTRODUCTION	401	SP-302-34
RESEARCH SIGNIFICANCE	402	The Influe
EXPERIMENTAL PROCEDURES	403	on the For
EXPERIMENTAL RESULTS	AND	of Concret
DISCUSSION	407	by Lucia Fe
CONCLUSIONS	412	Boustingor
FURTHER RESEARCH	413	INTRODUC
		RESEARCH
SP-302-31	415	EXPERIME
Enhancing Workability Retention	on of	THE GROU
Concrete Containing Natural Ze	olite	ANALYTIC
by Superplasticizers' Combinat	tion	COMPARIS
by Hessam AzariJafari, Mohamm	ad	EXPERIME
Shekarchi, Javad Berenjian, and		EXPERIME
Babak Ahmadi		DISCUSSIC
INTRODUCTION	415	FURTHER
RESEARCH SIGNIFICANCE	416	CONCLUS
EXPERIMENTAL INVESTIGATIO	N 416	
EXPERIMENTAL RESULTS	AND	SP-302-35

EXPERIMENTAL	RESULTS	AND
DISCUSSION		418
CONCLUSIONS		421

SP-302-32

425

Fluidity Change of Cement Paste with Superplasticizer by K₂SO₄ and KF

by Kazuki Matsuzawa, Daiki Atarashi, Masahiro Miyauchi, and Etsuo Sakai **INTRODUCTION** 425 **RESEARCH SIGNIFICANCE** 427 **EXPERIMENTAL INVESTIGATION 427**

EXPERIMENTAL	RESULTS	AND
DISCUSSION		429
CONCLUSIONS		432

SP-302-33

Cement Recycling System Using Sodium Gluconate

y Daiki Atarashi, Yutaka Aikawa, 'uya Yoda, Masahiro Miyauchi, and Itsuo Sakai

NTRODUCTION 437 RESEARCH SIGNIFICANCE 438 **EXPERIMENTAL INVESTIGATION 439** EXPERIMENTAL RESULTS AND DISCUSSION 440 CONCLUSIONS 445

SP-302-34

449

437

The Influence of Paste Thixotropy on the Formwork-Filling Properties of Concrete y Lucia Ferrari and Pascal Boustingorry NTRODUCTION 449 RESEARCH SIGNIFICANCE 450 EXPERIMENTAL INVESTIGATION AT THE GROUT SCALE 450 ANALYTICAL INVESTIGATION 452 COMPARISON OF PREDICTIONS AND EXPERIMENTAL RESULTS 453 EXPERIMENTAL RESULTS AND DISCUSSION 455 FURTHER RESEARCH 460 CONCLUSIONS 461

463

Interaction of Montmorillonite with Poly(ethylene Glycol) and Poly(methacrylic Acid) Polymers. Consequences on the Influence of **Clays on Superplasticizer Efficiency** by Rachid Ait-Akbour, Christine Taviot-Guého, Fabrice Leroux, Pascal Boustingorry, and Frédéric Leising **INTRODUCTION** 463 **RESEARCH SIGNIFICANCE** 464 EXPERIMENTAL PROCEDURES 464

EXPERIMENTAL RESULTS	AND	SP-302-37	491
DISCUSSION	466	Admixture Concepts for the Sub	-
CONCLUSIONS	474	4 Saharan African Environment with	
		Indigenous Raw Materials	
SP-302-36	477	by Wolfram Schmidt, Nsesheye S.	
Plasticizing Geopolymer-Type		Msinjili, Herbert C. Uzoegbo, and J	lohn
Auspensions: A Challenge		K. Makunza	
by L. Nicoleau, M. Pulkin, and T.		INTRODUCTION	491
Mitkina		RESEARCH SIGNIFICANCE	494
INTRODUCTION	477	EXPERIMENTAL PROCEDURE	494
RESEARCH SIGNIFICANCE	478	OBSERVATIONS	497
EXPERIMENTAL SECTION	478	COMPARISON OF THE CONC	CEPT
EXPERIMENTAL RESULTS	AND	WITH DATA FROM PRACTICE	503
DISCUSSION	479	FURTHER RESEARCH	503
CONCLUSIONS	487	SUMMARY AND CONCLUSIONS	503

Index

507