

RILEM Bookseries

Viktor Mechtcherine  
Kamal Khayat  
Egor Secrieru *Editors*

# Rheology and Processing of Construction Materials

RheoCon2 & SCC9



 Springer

The Springer logo features a stylized white chess knight piece on a red background, positioned to the left of the word "Springer" in a white, serif font.

# **Rheology and Processing of Construction Materials**

## **RILEM BOOKSERIES**

### **Volume 23**

RILEM, The International Union of Laboratories and Experts in Construction Materials, Systems and Structures, founded in 1947, is a non-governmental scientific association whose goal is to contribute to progress in the construction sciences, techniques and industries, essentially by means of the communication it fosters between research and practice. RILEM's focus is on construction materials and their use in building and civil engineering structures, covering all phases of the building process from manufacture to use and recycling of materials. More information on RILEM and its previous publications can be found on [www.RILEM.net](http://www.RILEM.net). Indexed in SCOPUS, Google Scholar and SpringerLink.



More information about this series at <http://www.springer.com/series/8781>

Viktor Mechtcherine · Kamal Khayat ·  
Egor Secrieru  
Editors

# Rheology and Processing of Construction Materials

RheoCon2 & SCC9

 Springer

*Editors*

Viktor Mechtcherine  
Faculty of Civil Engineering  
Technische Universität Dresden  
Dresden, Sachsen, Germany

Kamal Khayat  
Missouri University of Science  
and Technology  
Rolla, MO, USA

Egor Secrieru  
Faculty of Civil Engineering  
TU Dresden  
Dresden, Sachsen, Germany

ISSN 2211-0844

ISSN 2211-0852 (electronic)

RILEM Bookseries

ISBN 978-3-030-22565-0

ISBN 978-3-030-22566-7 (eBook)

<https://doi.org/10.1007/978-3-030-22566-7>

© RILEM 2020

No part of this work may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying, microfilming, recording or otherwise, without written permission from the Publisher, with the exception of any material supplied specifically for the purpose of being entered and executed on a computer system, for exclusive use by the purchaser of the work.

This Springer imprint is published by the registered company Springer Nature Switzerland AG  
The registered company address is: Gewerbestrasse 11, 6330 Cham, Switzerland

# Preface

Processing of building materials is the technological backbone in the modern construction industry. Tailored use of rheology-based processes is not only a vital key for solving current technical challenges, including mixing, transportation, casting, or pumping over extreme lengths and heights, but also for the design of emerging and highly innovative technologies, such as digital fabrication. These processes are carried out under a broad range of deformation rates, which result in the necessity of profound knowledge about material rheological behavior applying advanced experimental and numerical methods.

Following the motto “Mastering rheology-based processes,” the 2nd International Conference on Rheology and Processing of Construction Materials (RheoCon2) and the 9th International RILEM Symposium on Self-Compacting Concrete (SCC9) were held on September 8 to 11, 2019, in Radebeul, Germany.

The RILEM SCC series of symposia started in 1999 in Stockholm, followed by Tokyo in 2001, Reykjavik in 2003, Chicago in 2005, Ghent in 2007, Montreal in 2010, Paris in 2013, and Washington, D.C. in 2016 with a steadily increasing number of papers, participants, and interests from across the globe. The first RheoCon conference was successfully organized in Paris in 2013 in conjunction with the RILEM SCC symposium.

By combining these two parallel and closely interconnected conferences, we succeeded in creating a platform for exchanging experience and ideas about the development, testing, applications, and numerical simulation of fresh properties of cement-based and other building materials with emphasis on rheological properties.

The SCC9 symposium was organized in recognition of Professor Kamal H. Khayat’s impressive scientific research achievements, exceptional engagement and contribution to concrete rheology, in general, and self-compacting concrete, in particular, as well as his sustained leadership in technical societies and technology transfer.

The conference proceedings consist of 76 peer-reviewed papers. Topics covered include materials science and design, the effect of additions and admixtures on rheology, rheological testing, mixing, processing and casting, additive manufacturing, and 3D printing. Furthermore, contributions deal with rheology and flow

modeling of SCC as well as its durability, structural performance, and fiber reinforcement.

The three-day conference program comprised of a selected panel of seven keynote speakers, and over 110 oral and 15 poster presentations. With participants from more than 30 countries, the conference triggered a vibrant discussion on ongoing research, networking, and sharing of innovative visions on the bright and sustainable future of the construction industry.

The latest scientific findings from the Priority Program 2005 *OPUS FLUIDUM FUTURUM* – Rheology of reactive, multiscale, multiphase construction materials, sponsored by the German Research Foundation (DFG), were also presented at the conference. The program was initiated in the early 2018, and it was a unique opportunity for the members who represent an interdisciplinary research community to actively participate in the tandem conference.

We would like to express our sincere gratitude to the Honorary Advisory Committee and the Scientific and Technical Committee for its support in putting together a high-caliber technical program, providing peer review to numerous papers and promoting the conference worldwide. Our gratitude also goes to members of the Organising Committee and especially to Ms. Shirin Fataei for their dedicated efforts to ensuring a successful international conference.

Our special thanks to the conference sponsors: BASF, Deutsche Bauchemie, CEMEX, KNIELE, Omya, Maschinenfabrik Gustav Eirich, Schleibinger Geräte Teubert u. Greim, Thermo Fisher Scientific and UltraTest. Their generous financial support is greatly acknowledged.

September 2019

Editors

# Organization

## Conference Chair

Viktor Mechtcherine, Germany

## Honorary Advisory Committee

Geert De Schutter (Chair of SCC 2007), Belgium  
Kamal H. Khayat (Chair of SCC 2010, 2016), USA  
Nicolas Roussel (Chair of SCC 2013), France  
Surendra P. Shah (Chair of SCC 2005, 2008), USA  
Olafur H. Wallevik (Chair of SCC 2003), Iceland

## International Scientific Committee

Hakim S. Abdelgader, Libya  
Rolf Breitenbücher, Germany  
Myoungsung Choi, Republic of Korea  
Bart Craeye, Belgium  
Geert De Schutter, Belgium  
Khadija El Cheikh, Belgium  
Tahir K. Erdem, Turkey  
Vyacheslav Falikman, Russia  
Shirin Fataei, Germany  
Liberato Ferrara, Italy  
Dimitri Feys, USA  
Robert Flatt, Switzerland  
Albrecht Gilka-Bötzow, Germany  
Jacek Golaszewski, Poland  
Annika Gram, Sweden  
Steffen Grunewald, Netherlands  
Michael Haist, Germany



Daniel Jansen, Germany  
Steffen Jesinghausen, Germany  
Helena Keller, Germany  
Kamal H. Khayat, USA  
Michael Khrapko, New Zealand  
Jae H. Kim, Korea  
Thomas Kränkel, Germany  
Hans Krauss, Germany  
Markus Krüger, Germany  
Lei Lei, Germany  
Marco Liebscher, Germany  
Ludger Lohaus, Germany  
Dirk Lowke, Germany  
Zichen Lu, Germany  
Pietro Lura, Switzerland  
Viktor Mechtcherine (Chair), Germany  
Behzad Nematollahi, Australia  
Masahiro Ouchi, Japan  
Arnaud Perot, France  
Johann Plank, Germany  
Ye Qian, Singapore  
Nicolas Roussel, France  
Manu Santhanam, India  
Carsten Schilde, Germany  
Wolfram Schmidt, Germany  
Christof Schröfl, Germany  
Rüdiger Schwarze, Germany  
Egor Secrieru, Germany  
Surendra P. Shah, USA  
Kosmas Sideris, Greece  
Dietmar Stephan, Germany  
Neven Ukrainczyk, Germany  
Gideon van Zijl, South Africa  
Yannick Vanhove, France  
Ksenja Vasilic, Germany  
Jon Wallevik, Iceland  
Timothy Wangler, Switzerland  
Folker H. Wittmann, Germany  
Ammar Yahia, Canada  
Qiang Yuan, China

### **International Technical Committee**

Sofiane Amziane, France  
Harald Beitzel, Germany

Peter Billberg, Sweden  
Mette Geiker, Norway  
Shiho Kawashima, USA  
Maria Konsta-Gdoutos, Greece  
Changwen Miao, China  
Anton Schindler, USA  
Norbert Schroeter, Germany  
Caijun Shi, China  
Mohammed Sonebi, UK  
Le Trung Thanh, Vietnam  
Lars N. Thrane, Denmark  
Nathan A. Tregger, USA  
Olafur H. Wallevik, Iceland  
Norbert Willenbacher, Germany

### **Local Organising Committee**

Viktor Mechtcherine  
Martina Awassi  
Katrin Brothuhn  
Shirin Fataei  
Irina Ivanova  
Egor Secieru  
Venkatesh N. Nerella

# Contents

## Materials Science and Design

<b>Influence of Waste Tire Rubber on Fresh and Hardened Properties of Self-Compacting Rubberized Concrete (SCRC) . . . . .</b>	<b>3</b>
Robert Bušić and Ivana Miličević	
<b>Novel Mix Design Methodology for Self-Compacting Steel-Fiber Reinforced Concrete Based on Rheological and Mechanical Concepts . . . . .</b>	<b>11</b>
Ángel de la Rosa, Elisa Poveda, Gonzalo Ruiz, and Héctor Cifuentes	
<b>Innovative Use of Fine and Ultrafine GCC in Cementitious Systems . . .</b>	<b>19</b>
Pascal Gonnon, Philipp Mueller, and Thomas Lys	
<b>Use of Surfactant to Improve Properties of Crumb Rubbers in Concrete Products . . . . .</b>	<b>27</b>
Marupatch Jamnongwong and Piti Sukontasukkul	
<b>Structural Build-Up of Cementitious Paste Under External Magnetic Fields . . . . .</b>	<b>36</b>
Dengwu Jiao, Khadija El Cheikh, Karel Lesage, Caijun Shi, and Geert De Schutter	
<b>Influence of Aggregate Particle Size Distribution on Mixing Behavior and Rheological Properties of Low-Binder Concrete . . . . .</b>	<b>43</b>
Markus Samuel Rebmann and Rafael Giuliano Pileggi	
<b>Suspensions Sedimenting in a Horizontal Annulus – A Model for Oilfield Cements in Horizontal Wells . . . . .</b>	<b>52</b>
Agathe Robisson, Teresa Liberto, and Elizabeth B. Dussan V.	
<b>SCC for Sub-Saharan Africa Based on Local Raw Materials – Material Development, Optimisation, and Application Concept . . . . .</b>	<b>60</b>
Wolfram Schmidt	

## **Effect of Supplementary Cementitious Materials, Fillers and Chemical Admixtures on Rheology**

<b>Effect of Sodium Sulphate on Rheological Behaviour of Alkali Activated Slag Binders</b> . . . . .	71
Nedunuri Sai Surya Sree Aparna and Muhammad Salman	
<b>Bio-Derived Rheology Modifying Agents for Cement-Based Materials</b> . . . . .	79
Mahzad Azima and Zeynep Başaran Bundur	
<b>Influence of Cements Containing Calcareous Fly Ash on Rheological Properties of Fresh Mortars and Its Variability</b> . . . . .	87
Jacek Gołaszewski, Tomasz Ponikiewski, and Aleksandra Kostrzanowska-Siedlarz	
<b>Early Properties of Portland Cements with Varied Set Regulators</b> . . . . .	97
Tamino Hirsch, Tobias Dorn, and Dietmar Stephan	
<b>Influence of Different Accelerators on the Rheology and Early Hydration of Cement Paste</b> . . . . .	106
Sarah Leinitz, Zichen Lu, Simon Becker, Dietmar Stephan, Regine von Klitzing, and Wolfram Schmidt	
<b>Effect of Mineral Additions on Rheology and Fresh Properties of Cement Pastes and Mortars</b> . . . . .	116
Dorota Małaszkiwicz and Mateusz Osipiuk	
<b>Effect of the Side Chain Density and Length of Polycarboxylate Ether Superplasticizers on the Thixotropic Structural Build-Up of Cement Paste</b> . . . . .	125
David Nicia and Dirk Lowke	
<b>Interaction of Superplasticizers with Cement from the Point of View of Colloid Chemistry</b> . . . . .	134
Johann Plank and Manuel Ilg	
<b>Improvement of UHPFRC-Rheology by Using Circular Shape Memory Alloy Fibres</b> . . . . .	142
Maximilian Schleiting, Alexander Wetzel, Florian Gerland, Thomas Niendorf, Olaf Wunsch, and Bernhard Middendorf	
<b>Laboratory and In-Situ Rheological Testing</b>	
<b>The Use of Parallel-Plate Rotational Rheometry to Determine the Superplasticizer to be Used in Cement Pastes Admixtures</b> . . . . .	151
Livia B. Agostinho, Eugenia F. da Silva, Luciana A. Farias, and Alexandre C. Pereira	

**Rheology and Build-Up of Fresh SCC Pastes Evaluated with the Mini-slump Cone Test** . . . . . 160  
 Gonzalo Barluenga, Irene Palomar, Cynthia Guardia, Hugo Varela, and Francisco Hernandez-Olivares

**About the Influence of Shear-Induced Particle Migration and Sedimentation on the Measurement Results of Concrete Rheometers** . . . 168  
 Christian Baumert and Harald Garrecht

**On-Board Concrete Rheology Measurements Using an In-Drum Sensor System: Early Stages** . . . . . 174  
 Xavier Berger, Pierre Siccardi, Robin Jean, Marc Jolin, Denis Beaupre, and Benoît Bissonnette

**Experimental Developments of the Squeeze Flow Test for Mortars** . . . . 182  
 Fábio A. Cardoso, Franco A. Grandes, Victor K. Sakano, Andressa C. A. Rego, Fábio C. Lofrano, Vanderley M. John, and Rafael G. Pileggi

**Measuring the Impact Behavior of Fresh Mortars by Pressure Mapping** . . . . . 191  
 Victor K. Sakano, Franco A. Grandes, Fábio A. Cardoso, Fábio L. Campora, Roberto C. O. Romano, and Rafael G. Pileggi

**Evaluation of Fresh Adhesive Mortars Through Various Rheological and Imaging Techniques** . . . . . 200  
 Alessandra L. Fujii-Yamagata, Fábio A. Cardoso, Anne Daubresse, Evelyne Prat, and Mohend Chaouche

**Evaluation of Structural Build-Up Rate of Cementitious Materials by Means of Constant Shear Rate Test: Parameter Study** . . . . . 209  
 Irina Ivanova and Viktor Mechtcherine

**Comparing Phase Development and Rheological Properties of OPC Paste Within the First Hour of Hydration** . . . . . 219  
 Cordula Jakob, Daniel Jansen, Ursula Pott, and Jürgen Neubauer

**Challenges in Rheological Characterization of Cement Pastes Using a Parallel-Plates Geometry** . . . . . 228  
 Aida Margarita Ley-Hernández and Dimitri Feys

**Correlation Between “Very Early” Age Fracture Performance and Evolution of Rheological Properties of High Performance Fiber Reinforced Cementitious Composites with Adapted Rheology** . . . 237  
 Francesco Lo Monte, Gabriele Zago, Marco Cucchi, and Liberato Ferrara

**Investigation of the Early Cement Hydration with a New Penetration Test, Rheometry and In-Situ XRD** . . . . . 246  
 Ursula Pott, Clemens Ehm, Cordula Jakob, and Dietmar Stephan

<b>Use of Combined Rheo-NMR to Investigate the Relationship Between the Molecular and Mechanical Properties of Early Cement Paste Hydration</b> .....	256
Nonkululeko W. Radebe, Karl-Friedrich Ratzsch, Christopher O. Klein, and Manfred Wilhelm	
<b>Calibration of ASTM C230 Cone for Measuring Flow Diameter of Self-flowing Mortar According to the EFNARC Recommendation</b> . . .	266
Shamir Sakir, Sudharshan N. Raman, A. B. M. Amrul Kaish, and Azrul A. Mutalib	
<b>Thixotropy-Dependent Form Filling Ability of Cement Paste</b> .....	273
Mareike Thiedeitz, Thomas Kränkel, and Christoph Gehlen	
<b>Mixing, Processing and Casting of Mortar and Concrete</b>	
<b>Comparative Study on the Effect of Mixer Type on Properties of Self-compacting Mortar</b> .....	283
Bart Craeye, Wim Bastiaens, Erik Coppens, Dirk Van Houdt, Wilfried Gijbels, and Thomas Rondou	
<b>Effect of Electromagnetic Pulsation on the Rheological Properties of Mortars During Pumping</b> .....	294
Inka Dreßler, Patrick Varady, Hans-Werner Krauss, and Dirk Lowke	
<b>Influence of Aggregate Volume Fraction on Concrete Pumping Behaviour</b> .....	303
Shirin Fataei, Egor Secieru, and Viktor Mechtcherine	
<b>Effect of Mixing Procedure on the Rheological Properties and Hydration Kinetics of Portland Cement Paste</b> .....	311
Danila Fabiane Ferraz, Ariane C. R. Martho, Elizabeth G. Burns, Roberto C. O. Romano, and Rafael G. Pileggi	
<b>Development of SCC Placement Methodology for the Monolithic Construction of Slab-to-Wall Members Using Formwork Pressure and Time of Set-Based Modeling</b> .....	320
Boris Haranki and Ufuk Dilek	
<b>Influence of Segregation on Materials Component in Fresh Concrete Due to Vibration</b> .....	329
Kazuaki Nishimura and Yoshitaka Kato	
<b>Study of the Mixing Completion in Concrete Production by Means of an on-Board Sensor System</b> .....	338
Pierre Siccardi, Xavier Berger, Robin Jean, Marc Jolin, Benoît Bissonnette, and Denis Beaupré	

**Pumping Process of High Strength Self-consolidating Concrete in the Construction of Skyscraper** ..... 346  
 Peiyu Yan, Jianguo Han, Mengyuan Li, and Yu Liu

**Additive Manufacturing and 3D-Printing**

**Hardened Properties of 3D Printable Ultra-High Performance Fiber-Reinforced Concrete for Digital Construction Applications** ..... 355  
 Ravendran Arunothayan, Behzad Nematollahi, Shin Hau Bong, Ravi Ranade, and Jay Sanjayan

**Properties of 3D-Printable Ductile Fibre-Reinforced Geopolymer Composite for Digital Construction Applications** ..... 363  
 Shin Hau Bong, Behzad Nematollahi, Ming Xia, Ali Nazari, Jay Sanjayan, and Jinlong Pan

**Rheology of 3D Printable Lightweight Foam Concrete Incorporating Nano-Silica** ..... 373  
 Seung Cho, Jacques Kruger, Algurnon van Rooyen, Stephan Zeranka, and Gideon van Zijl

**Study on the Influence of Accelerators on the Hydration of Portland Cement and Their Applicability in 3D Printing** ..... 382  
 Tobias Dorn, Tamino Hirsch, and Dietmar Stephan

**Predication of Strength-Based Failure in Extrusion-Based 3D Concrete Printing** ..... 391  
 Roshan I. Jayathilakage, Pathmanathan Rajeev, and Jay Sanjayan

**Quantifying Constructability Performance of 3D Concrete Printing via Rheology-Based Analytical Models** ..... 400  
 Jacques Kruger, Stephan Zeranka, and Gideon van Zijl

**Extrusion of Lightweight Concrete: Rheological Investigations** ..... 409  
 Carla Matthäus, Daniel Weger, Thomas Kränkel, Luis Santos Carvalho, and Christoph Gehlen

**Enhancing Strength of Powder-Based 3D Printed Geopolymers for Digital Construction Applications** ..... 417  
 Behzad Nematollahi, Ming Xia, and Jay Sanjayan

**Rheology and Structural Rebuilding of One-Part Geopolymer Mortar in the Context of 3D Concrete Printing** ..... 426  
 Biranchi Panda, Nisar Ahamed Noor Mohamed, and Ming Jen Tan

**Rheology of Fresh Concrete: Historical Perspective and Glance in the Future** ..... 432  
 Surendra P. Shah and Jae Hong Kim

<b>Processing of Set on Demand Solutions for Digital Fabrication in Architecture</b> .....	440
Anna Szabo, Lex Reiter, Ena Lloret-Fritschi, Fabio Gramazio, Matthias Kohler, and Robert J. Flatt	
<b>Residence Time Distributions in Continuous Processing of Concrete</b> . . .	448
Timothy Wangler, Fabio Scotto, Ena Lloret-Fritschi, and Robert J. Flatt	
<b>Post-processing Techniques to Enhance Strength of Portland Cement Mortar Digitally Fabricated Using Powder-Based 3D Printing Process</b> .....	457
Ming Xia, Behzad Nematollahi, and Jay Sanjayan	
 <b>Rheology and Workability of SCC</b>	
<b>Rheology Study of Fresh Self-compacting Concrete Made Using Recycled Fine Aggregates</b> .....	467
Monalisa Behera, Ashwani K. Minocha, Sriman K. Bhattacharyya, and Mohammad R. Rahman	
<b>Experimental Study of Formwork Tightness as a Function of Rheological Properties of SCC</b> .....	476
Chizya Chibulu, Khadija El Cheikh, Mert Y. Yardimci, and Geert De Schutter	
<b>The Effect of Fiber Geometry and Concentration on the Flow Properties of UHPC</b> .....	482
Florian Gerland, Maximilian Schleiting, Thomas Schomberg, Olaf Wunsch, Alexander Wetzel, and Bernhard Middendorf	
<b>Rheological Characterization of Self-compacting Concrete Pastes with Polymeric Admixtures</b> .....	491
Irene Palomar, Gonzalo Barluenga, Cynthia Guardia, Ma Cruz Alonso, and Marina Álvarez	
<b>Effect of Limestone Powder Addition Quality on SCC Rheology</b> .....	500
Damien Rangeard, Arnaud Perrot, and Malalasoia Rodomond	
<b>Rheological and Mechanical Properties of Alkali-Activated Hybrid Matrix for Self-consolidating Concrete</b> .....	508
Yasser Rifaai, Ammar Yahia, Ahmed Mostafa, Salima Aggoun, and El-Hadj Kadri	
<b>Effects of Nanoclays on SCC Paste Rheology</b> .....	517
Hugo Varela, Gonzalo Barluenga, Irene Palomar, and Alberto Sepulcre	



**Mechanical Properties, Durability and Sustainability of SCC**

**Revised Macro-cracking Criterion for Massive Non-reinforced Self-compacting Concrete Structures Under Thermal Load Based on Extensive Experimental Testing and Field Observations . . . . .** 527  
 Bart Craeye, Lou Areias, Maarten Van Geet, and Saeid Babaei

**Experimental Investigation on Mechanical Properties of Fiber Reinforced Lightweight Self-consolidating Concrete . . . . .** 536  
 Ali Ehsani Yeganeh, Farzad Kouroshnezhad, Sina Dadsetan, Khandaker M. A. Hossain, and Mohamed Lachemi

**Utilization of Copper Slag in Self-compacting Concrete - Strength and Permeation Properties . . . . .** 544  
 Nikita Gupta and Rafat Siddique

**Characterization of Non-proprietary UHPC for Use in Rehabilitation/Strengthening Applications . . . . .** 552  
 Ana Mafalda Matos, Sandra Nunes, Carla Costa, and José L. Barroso-Aguiar

**The Applicability of Reclaimed Concrete Granulate to SCC . . . . .** 560  
 Maciej Urban and Małgorzata Lenart

**Modelling and Numerical Simulations of Rheological Behaviour**

**Particle Interactions in Silica Systems in Presence of Superplasticizer . . . . .** 571  
 Simon Becker, Zichen Lu, Sarah Leinitz, Wolfram Schmidt, Dietmar Stephan, and Regine von Klitzing

**Fresh Concrete Pumping Arrest Investigation for Thixotropy by a CFD Modelling Approach . . . . .** 580  
 Robin De Schryver, Khadija El Cheikh, Mert Y. Yardimci, Karel Lesage, and Geert De Schutter

**Numerical Simulation of the Flow Behavior of Newtonian Fluids in a Wide Gap Rheometer by CFD . . . . .** 588  
 Mahmoud Eslami Pirharati, Dimitri Ivanov, Hans-W. Krauss, Carsten Schilde, and Dirk Lowke

**Segregation of Granular Material During the Transport in Pipes . . . . .** 596  
 Martin A. Haustein and Rüdiger Schwarze

**Synthesis and Analysis of Spherical Cementitious Model Particles . . . . .** 602  
Dimitri Ivanov, Simon Becker, Zichen Lu, Mahmoud Eslami Pirharati,  
Arno Kwade, Hans-W. Krauss, Dietmar Stephan, Regine von Klitzing,  
and Carsten Schilde

**Comparison of Water-Isopropanol Replacement and Lyophilisation  
for Hydration Stop of Cementitious Suspensions . . . . .** 610  
Patrick A. Kißling, Dario Cotardo, Tabea von Bronk, Ludger Lohaus,  
and Nadja C. Bigall

**Rheological Properties of Silica Beads in the Presence of Different  
Polymers and Electrolyte . . . . .** 619  
Zichen Lu, Simon Becker, Sarah Leinitz, Regine von Klitzing,  
Wolfram Schmidt, and Dietmar Stephan

**A Plasticity Theory Approach for the Stability Analysis of Vertical  
Layers of Concrete in the Fresh State . . . . .** 628  
Giacomo Torelli and Janet M. Lees

**Hydrating Cement Particle Interaction Model for Yield  
Stress Analysis . . . . .** 636  
Neven Ukrainczyk, Antonio Caggiano, Diego Said Schicchi,  
Albrecht Gilka-Bötzow, and Eddie Koenders

**Measuring Thixotropic Properties in a Truck Mixer - Analysis  
by Numerical Simulation Using the PFI Material Model . . . . .** 644  
Jon Elvar Wallevik

**Computational Segregation Analysis During Casting of SCC. . . . .** 652  
Jon Elvar Wallevik, Wassim Mansour, and Olafur Haralds Wallevik

**Author Index. . . . .** 661

# RILEM Publications

The following list is presenting the global offer of RILEM Publications, sorted by series. Each publication is available in printed version and/or in online version.

## RILEM Proceedings (PRO)

**PRO 1:** Durability of High Performance Concrete (ISBN: 2-912143-03-9; e-ISBN: 2-351580-12-5; e-ISBN: 2351580125); *Ed. H. Sommer*

**PRO 2:** Chloride Penetration into Concrete (ISBN: 2-912143-00-04; e-ISBN: 2912143454); *Eds. L.-O. Nilsson and J.-P. Ollivier*

**PRO 3:** Evaluation and Strengthening of Existing Masonry Structures (ISBN: 2-912143-02-0; e-ISBN: 2351580141); *Eds. L. Binda and C. Modena*

**PRO 4:** Concrete: From Material to Structure (ISBN: 2-912143-04-7; e-ISBN: 2351580206); *Eds. J.-P. Bournazel and Y. Malier*

**PRO 5:** The Role of Admixtures in High Performance Concrete (ISBN: 2-912143-05-5; e-ISBN: 2351580214); *Eds. J. G. Cabrera and R. Rivera-Villarreal*

**PRO 6:** High Performance Fiber Reinforced Cement Composites - HPRCC 3 (ISBN: 2-912143-06-3; e-ISBN: 2351580222); *Eds. H. W. Reinhardt and A. E. Naaman*

**PRO 7:** 1st International RILEM Symposium on Self-Compacting Concrete (ISBN: 2-912143-09-8; e-ISBN: 2912143721); *Eds. Å. Skarendahl and Ö. Petersson*

**PRO 8:** International RILEM Symposium on Timber Engineering (ISBN: 2-912143-10-1; e-ISBN: 2351580230); *Ed. L. Boström*

**PRO 9:** 2nd International RILEM Symposium on Adhesion between Polymers and Concrete ISAP'99 (ISBN: 2-912143-11-X; e-ISBN: 2351580249); *Eds. Y. Ohama and M. Puterman*

**PRO 10:** 3rd International RILEM Symposium on Durability of Building and Construction Sealants (ISBN: 2-912143-13-6; e-ISBN: 2351580257); *Ed. A. T. Wolf*

**PRO 11:** 4th International RILEM Conference on Reflective Cracking in Pavements (ISBN: 2-912143-14-4; e-ISBN: 2351580265); *Eds. A. O. Abd El Halim, D. A. Taylor and El H. H. Mohamed*

**PRO 12:** International RILEM Workshop on Historic Mortars: Characteristics and Tests (ISBN: 2-912143-15-2; e-ISBN: 2351580273); *Eds. P. Bartos, C. Groot and J. J. Hughes*

**PRO 13:** 2nd International RILEM Symposium on Hydration and Setting (ISBN: 2-912143-16-0; e-ISBN: 2351580281); *Ed. A. Nonat*

**PRO 14:** Integrated Life-Cycle Design of Materials and Structures - ILCDES 2000 (ISBN: 951-758-408-3; e-ISBN: 235158029X); (ISSN: 0356-9403); *Ed. S. Sarja*

**PRO 15:** Fifth RILEM Symposium on Fibre-Reinforced Concretes (FRC) - BEFIB'2000 (ISBN: 2-912143-18-7; e-ISBN: 291214373X); *Eds. P. Rossi and G. Chanvillard*

**PRO 16:** Life Prediction and Management of Concrete Structures (ISBN: 2-912143-19-5; e-ISBN: 2351580303); *Ed. D. Naus*

**PRO 17:** Shrinkage of Concrete – Shrinkage 2000 (ISBN: 2-912143-20-9; e-ISBN: 2351580311); *Eds. V. Baroghel-Bouny and P.-C. Aïtcin*

**PRO 18:** Measurement and Interpretation of the On-Site Corrosion Rate (ISBN: 2-912143-21-7; e-ISBN: 235158032X); *Eds. C. Andrade, C. Alonso, J. Fullea, J. Polimon and J. Rodriguez*

**PRO 19:** Testing and Modelling the Chloride Ingress into Concrete (ISBN: 2-912143-22-5; e-ISBN: 2351580338); *Eds. C. Andrade and J. Kropp*

**PRO 20:** 1st International RILEM Workshop on Microbial Impacts on Building Materials (CD 02) (e-ISBN 978-2-35158-013-4); *Ed. M. Ribas Silva*

**PRO 21:** International RILEM Symposium on Connections between Steel and Concrete (ISBN: 2-912143-25-X; e-ISBN: 2351580346); *Ed. R. Eligehausen*

**PRO 22:** International RILEM Symposium on Joints in Timber Structures (ISBN: 2-912143-28-4; e-ISBN: 2351580354); *Eds. S. Aicher and H.-W. Reinhardt*

**PRO 23:** International RILEM Conference on Early Age Cracking in Cementitious Systems (ISBN: 2-912143-29-2; e-ISBN: 2351580362); *Eds. K. Kovler and A. Bentur*

**PRO 24:** 2nd International RILEM Workshop on Frost Resistance of Concrete (ISBN: 2-912143-30-6; e-ISBN: 2351580370); *Eds. M. J. Setzer, R. Auberg and H.-J. Keck*

**PRO 25:** International RILEM Workshop on Frost Damage in Concrete (ISBN: 2-912143-31-4; e-ISBN: 2351580389); *Eds. D. J. Janssen, M. J. Setzer and M. B. Snyder*

**PRO 26:** International RILEM Workshop on On-Site Control and Evaluation of Masonry Structures (ISBN: 2-912143-34-9; e-ISBN: 2351580141); *Eds. L. Binda and R. C. de Vekey*

**PRO 27:** International RILEM Symposium on Building Joint Sealants (CD03; e-ISBN: 235158015X); *Ed. A. T. Wolf*

**PRO 28:** 6th International RILEM Symposium on Performance Testing and Evaluation of Bituminous Materials - PTEBM'03 (ISBN: 2-912143-35-7; e-ISBN: 978-2-912143-77-8); *Ed. M. N. Partl*

**PRO 29:** 2nd International RILEM Workshop on Life Prediction and Ageing Management of Concrete Structures (ISBN: 2-912143-36-5; e-ISBN: 2912143780); *Ed. D. J. Naus*

**PRO 30:** 4th International RILEM Workshop on High Performance Fiber Reinforced Cement Composites - HPRCC 4 (ISBN: 2-912143-37-3; e-ISBN: 2912143799); *Eds. A. E. Naaman and H. W. Reinhardt*

**PRO 31:** International RILEM Workshop on Test and Design Methods for Steel Fibre Reinforced Concrete: Background and Experiences (ISBN: 2-912143-38-1; e-ISBN: 2351580168); *Eds. B. Schnütgen and L. Vandewalle*

**PRO 32:** International Conference on Advances in Concrete and Structures 2 vol. (ISBN (set): 2-912143-41-1; e-ISBN: 2351580176); *Eds. Ying-shu Yuan, Surendra P. Shah and Heng-lin Lü*

**PRO 33:** 3rd International Symposium on Self-Compacting Concrete (ISBN: 2-912143-42-X; e-ISBN: 2912143713); *Eds. Ó. Wallevik and I. Nielsson*

**PRO 34:** International RILEM Conference on Microbial Impact on Building Materials (ISBN: 2-912143-43-8; e-ISBN: 2351580184); *Ed. M. Ribas Silva*

**PRO 35:** International RILEM TC 186-ISA on Internal Sulfate Attack and Delayed Ettringite Formation (ISBN: 2-912143-44-6; e-ISBN: 2912143802); *Eds. K. Scrivener and J. Skalny*

**PRO 36:** International RILEM Symposium on Concrete Science and Engineering – A Tribute to Arnon Bentur (ISBN: 2-912143-46-2; e-ISBN: 2912143586); *Eds. K. Kovler, J. Marchand, S. Mindess and J. Weiss*

**PRO 37:** 5th International RILEM Conference on Cracking in Pavements – Mitigation, Risk Assessment and Prevention (ISBN: 2-912143-47-0; e-ISBN: 2912143764); *Eds. C. Petit, I. Al-Qadi and A. Millien*

**PRO 38:** 3rd International RILEM Workshop on Testing and Modelling the Chloride Ingress into Concrete (ISBN: 2-912143-48-9; e-ISBN: 2912143578); *Eds. C. Andrade and J. Kropp*

**PRO 39:** 6th International RILEM Symposium on Fibre-Reinforced Concretes - BEFIB 2004 (ISBN: 2-912143-51-9; e-ISBN: 2912143748); *Eds. M. Di Prisco, R. Felicetti and G. A. Plizzari*

**PRO 40:** International RILEM Conference on the Use of Recycled Materials in Buildings and Structures (ISBN: 2-912143-52-7; e-ISBN: 2912143756); *Eds. E. Vázquez, Ch. F. Hendriks and G. M. T. Janssen*

**PRO 41:** RILEM International Symposium on Environment-Conscious Materials and Systems for Sustainable Development (ISBN: 2-912143-55-1; e-ISBN: 2912143640); *Eds. N. Kashino and Y. Ohama*

**PRO 42:** SCC'2005 - China: 1st International Symposium on Design, Performance and Use of Self-Consolidating Concrete (ISBN: 2-912143-61-6; e-ISBN: 2912143624); *Eds. Zhiwu Yu, Caijun Shi, Kamal Henri Khayat and Youjun Xie*

**PRO 43:** International RILEM Workshop on Bonded Concrete Overlays (e-ISBN: 2-912143-83-7); *Eds. J. L. Granju and J. Silfwerbrand*

**PRO 44:** 2nd International RILEM Workshop on Microbial Impacts on Building Materials (CD11) (e-ISBN: 2-912143-84-5); *Ed. M. Ribas Silva*

**PRO 45:** 2nd International Symposium on Nanotechnology in Construction, Bilbao (ISBN: 2-912143-87-X; e-ISBN: 2912143888); *Eds. Peter J. M. Bartos, Yolanda de Miguel and Antonio Porro*

**PRO 46:** ConcreteLife'06 - International RILEM-JCI Seminar on Concrete Durability and Service Life Planning: Curing, Crack Control, Performance in Harsh Environments (ISBN: 2-912143-89-6; e-ISBN: 291214390X); *Ed. K. Kovler*

**PRO 47:** International RILEM Workshop on Performance Based Evaluation and Indicators for Concrete Durability (ISBN: 978-2-912143-95-2; e-ISBN: 9782912143969); *Eds. V. Baroghel-Bouny, C. Andrade, R. Torrent and K. Scrivener*

**PRO 48:** 1st International RILEM Symposium on Advances in Concrete through Science and Engineering (e-ISBN: 2-912143-92-6); *Eds. J. Weiss, K. Kovler, J. Marchand, and S. Mindess*

**PRO 49:** International RILEM Workshop on High Performance Fiber Reinforced Cementitious Composites in Structural Applications (ISBN: 2-912143-93-4; e-ISBN: 2912143942); *Eds. G. Fischer and V. C. Li*

**PRO 50:** 1st International RILEM Symposium on Textile Reinforced Concrete (ISBN: 2-912143-97-7; e-ISBN: 2351580087); *Eds. Josef Hegger, Wolfgang Brameshuber and Norbert Will*

**PRO 51:** 2nd International Symposium on Advances in Concrete through Science and Engineering (ISBN: 2-35158-003-6; e-ISBN: 2-35158-002-8); *Eds. J. Marchand, B. Bissonnette, R. Gagné, M. Jolin and F. Paradis*

**PRO 52:** Volume Changes of Hardening Concrete: Testing and Mitigation (ISBN: 2-35158-004-4; e-ISBN: 2-35158-005-2); *Eds. O. M. Jensen, P. Lura and K. Kovler*

**PRO 53:** High Performance Fiber Reinforced Cement Composites - HPRCC5 (ISBN: 978-2-35158-046-2; e-ISBN: 978-2-35158-089-9); *Eds. H. W. Reinhardt and A. E. Naaman*

**PRO 54:** 5th International RILEM Symposium on Self-Compacting Concrete (ISBN: 978-2-35158-047-9; e-ISBN: 978-2-35158-088-2); *Eds. G. De Schutter and V. Boel*

**PRO 55:** International RILEM Symposium Photocatalysis, Environment and Construction Materials (ISBN: 978-2-35158-056-1; e-ISBN: 978-2-35158-057-8); *Eds. P. Baglioni and L. Cassar*

**PRO 56:** International RILEM Workshop on Integral Service Life Modelling of Concrete Structures (ISBN 978-2-35158-058-5; e-ISBN: 978-2-35158-090-5); *Eds. R. M. Ferreira, J. Gulikers and C. Andrade*

**PRO 57:** RILEM Workshop on Performance of cement-based materials in aggressive aqueous environments (e-ISBN: 978-2-35158-059-2); *Ed. N. De Belie*

**PRO 58:** International RILEM Symposium on Concrete Modelling - CONMOD'08 (ISBN: 978-2-35158-060-8; e-ISBN: 978-2-35158-076-9); *Eds. E. Schlangen and G. De Schutter*

**PRO 59:** International RILEM Conference on On Site Assessment of Concrete, Masonry and Timber Structures - SACoMaTiS 2008 (ISBN set: 978-2-35158-061-5; e-ISBN: 978-2-35158-075-2); *Eds. L. Binda, M. di Prisco and R. Felicetti*

**PRO 60:** Seventh RILEM International Symposium on Fibre Reinforced Concrete: Design and Applications - BEFIB 2008 (ISBN: 978-2-35158-064-6; e-ISBN: 978-2-35158-086-8); *Ed. R. Gettu*

**PRO 61:** 1st International Conference on Microstructure Related Durability of Cementitious Composites 2 vol., (ISBN: 978-2-35158-065-3; e-ISBN: 978-2-35158-084-4); *Eds. W. Sun, K. van Breugel, C. Miao, G. Ye and H. Chen*

**PRO 62:** NSF/RILEM Workshop: In-situ Evaluation of Historic Wood and Masonry Structures (e-ISBN: 978-2-35158-068-4); *Eds. B. Kasal, R. Anthony and M. Drdácáký*

**PRO 63:** Concrete in Aggressive Aqueous Environments: Performance, Testing and Modelling, 2 vol., (ISBN: 978-2-35158-071-4; e-ISBN: 978-2-35158-082-0); *Eds. M. G. Alexander and A. Bertron*

**PRO 64:** Long Term Performance of Cementitious Barriers and Reinforced Concrete in Nuclear Power Plants and Waste Management - NUCPERF 2009 (ISBN: 978-2-35158-072-1; e-ISBN: 978-2-35158-087-5); *Eds. V. L'Hostis, R. Gens, C. Gallé*

**PRO 65:** Design Performance and Use of Self-consolidating Concrete - SCC'2009 (ISBN: 978-2-35158-073-8; e-ISBN: 978-2-35158-093-6); *Eds. C. Shi, Z. Yu, K. H. Khayat and P. Yan*

**PRO 66:** 2nd International RILEM Workshop on Concrete Durability and Service Life Planning - ConcreteLife'09 (ISBN: 978-2-35158-074-5; ISBN: 978-2-35158-074-5); *Ed. K. Kovler*

**PRO 67:** Repairs Mortars for Historic Masonry (e-ISBN: 978-2-35158-083-7); *Ed. C. Groot*

**PRO 68:** Proceedings of the 3rd International RILEM Symposium on 'Rheology of Cement Suspensions such as Fresh Concrete' (ISBN 978-2-35158-091-2; e-ISBN: 978-2-35158-092-9); *Eds. O. H. Wallevik, S. Kubens and S. Oesterheld*

**PRO 69:** 3rd International PhD Student Workshop on 'Modelling the Durability of Reinforced Concrete' (ISBN: 978-2-35158-095-0); *Eds. R. M. Ferreira, J. Gulikers and C. Andrade*

**PRO 70:** 2nd International Conference on 'Service Life Design for Infrastructure' (ISBN set: 978-2-35158-096-7, e-ISBN: 978-2-35158-097-4); *Eds. K. van Breugel, G. Ye and Y. Yuan*

**PRO 71:** Advances in Civil Engineering Materials – 'The 50-year Teaching Anniversary of Prof. Sun Wei' (ISBN: 978-2-35158-098-1; e-ISBN: 978-2-35158-099-8); *Eds. C. Miao, G. Ye, and H. Chen*

**PRO 72:** First International Conference on 'Advances in Chemically-Activated Materials – CAM'2010' (2010), 264 pp., ISBN: 978-2-35158-101-8; e-ISBN: 978-2-35158-115-5, *Eds. Caijun Shi and Xiaodong Shen*

**PRO 73:** 2nd International Conference on 'Waste Engineering and Management - ICWEM 2010' (2010), 894 pp., ISBN: 978-2-35158-102-5; e-ISBN: 978-2-35158-103-2, *Eds. J. Zh. Xiao, Y. Zhang, M. S. Cheung and R. Chu*

**PRO 74:** International RILEM Conference on 'Use of Superabsorbent Polymers and Other New Additives in Concrete' (2010) 374 pp., ISBN: 978-2-35158-104-9; e-ISBN: 978-2-35158-105-6; *Eds. O. M. Jensen, M. T. Hasholt, and S. Laustsen*

**PRO 75:** International Conference on 'Material Science - 2nd ICTRC - Textile Reinforced Concrete - Theme 1' (2010) 436 pp., ISBN: 978-2-35158-106-3; e-ISBN: 978-2-35158-107-0; *Ed. W. Brameshuber*



**PRO 76:** International Conference on ‘Material Science - HetMat - Modelling of Heterogeneous Materials - Theme 2’ (2010) 255 pp., ISBN: 978-2-35158-108-7; e-ISBN: 978-2-35158-109-4; *Ed. W. Brameshuber*

**PRO 77:** International Conference on ‘Material Science - AdIPoC - Additions Improving Properties of Concrete - Theme 3’ (2010) 459 pp., ISBN: 978-2-35158-110-0; e-ISBN: 978-2-35158-111-7; *Ed. W. Brameshuber*

**PRO 78:** 2nd Historic Mortars Conference and RILEM TC 203-RHM Final Workshop – HMC2010 (2010) 1416 pp., e-ISBN: 978-2-35158-112-4; *Eds. J. Válek, C. Groot, and J. J. Hughes*

**PRO 79:** International RILEM Conference on Advances in Construction Materials Through Science and Engineering (2011) 213 pp., ISBN: 978-2-35158-116-2, e-ISBN: 978-2-35158-117-9; *Eds. Christopher Leung and K. T. Wan*

**PRO 80:** 2nd International RILEM Conference on Concrete Spalling due to Fire Exposure (2011) 453 pp., ISBN: 978-2-35158-118-6, e-ISBN: 978-2-35158-119-3; *Eds. E. A. B. Koenders and F. Dehn*

**PRO 81:** 2nd International RILEM Conference on Strain Hardening Cementitious Composites (SHCC2-Rio) (2011) 451 pp., ISBN: 978-2-35158-120-9, e-ISBN: 978-2-35158-121-6; *Eds. R. D. Toledo Filho, F. A. Silva, E. A. B. Koenders and E. M. R. Fairbairn*

**PRO 82:** 2nd International RILEM Conference on Progress of Recycling in the Built Environment (2011) 507 pp., e-ISBN: 978-2-35158-122-3; *Eds. V. M. John, E. Vazquez, S. C. Angulo and C. Ulsen*

**PRO 83:** 2nd International Conference on Microstructural-related Durability of Cementitious Composites (2012) 250 pp., ISBN: 978-2-35158-129-2; e-ISBN: 978-2-35158-123-0; *Eds. G. Ye, K. van Breugel, W. Sun and C. Miao*

**PRO 84:** CONSEC13 - Seventh International Conference on Concrete under Severe Conditions – Environment and Loading (2013) 1930 pp., ISBN: 978-2-35158-124-7; e-ISBN: 978-2-35158-134-6; *Eds. Z. J. Li, W. Sun, C. W. Miao, K. Sakai, O. E. Gjorv and N. Banthia*

**PRO 85:** RILEM-JCI International Workshop on Crack Control of Mass Concrete and Related issues concerning Early-Age of Concrete Structures – ConCrack 3 – Control of Cracking in Concrete Structures 3 (2012) 237 pp., ISBN: 978-2-35158-125-4; e-ISBN: 978-2-35158-126-1; *Eds. F. Toutlemonde and J.-M. Torrenti*

**PRO 86:** International Symposium on Life Cycle Assessment and Construction (2012) 414 pp., ISBN: 978-2-35158-127-8, e-ISBN: 978-2-35158-128-5; *Eds. A. Ventura and C. de la Roche*

**PRO 87:** UHPFRC 2013 – RILEM-fib-AFGC International Symposium on Ultra-High Performance Fibre-Reinforced Concrete (2013), ISBN: 978-2-35158-130-8, e-ISBN: 978-2-35158-131-5; *Ed. F. Toutlemonde*

**PRO 88:** 8th RILEM International Symposium on Fibre Reinforced Concrete (2012) 344 pp., ISBN: 978-2-35158-132-2, e-ISBN: 978-2-35158-133-9; *Ed. Joaquim A. O. Barros*

**PRO 89:** RILEM International workshop on performance-based specification and control of concrete durability (2014) 678 pp., ISBN: 978-2-35158-135-3, e-ISBN: 978-2-35158-136-0; *Eds. D. Bjegović, H. Beushausen and M. Serdar*

**PRO 90:** 7th RILEM International Conference on Self-Compacting Concrete and of the 1st RILEM International Conference on Rheology and Processing of Construction Materials (2013) 396 pp., ISBN: 978-2-35158-137-7, e-ISBN: 978-2-35158-138-4; *Eds. Nicolas Roussel and Hela Bessaies-Bey*

**PRO 91:** CONMOD 2014 - RILEM International Symposium on Concrete Modelling (2014), ISBN: 978-2-35158-139-1; e-ISBN: 978-2-35158-140-7; *Eds. Kefei Li, Peiyu Yan and Rongwei Yang*

**PRO 92:** CAM 2014 - 2nd International Conference on advances in chemically-activated materials (2014) 392 pp., ISBN: 978-2-35158-141-4; e-ISBN: 978-2-35158-142-1; *Eds. Caijun Shi and Xiadong Shen*

**PRO 93:** SCC 2014 - 3rd International Symposium on Design, Performance and Use of Self-Consolidating Concrete (2014) 438 pp., ISBN: 978-2-35158-143-8; e-ISBN: 978-2-35158-144-5; *Eds. Caijun Shi, Zhihua Ou and Kamal H. Khayat*

**PRO 94 (online version):** HPRCC-7 - 7th RILEM conference on High performance fiber reinforced cement composites (2015), e-ISBN: 978-2-35158-146-9; *Eds. H. W. Reinhardt, G. J. Parra-Montesinos and H. Garrecht*

**PRO 95:** International RILEM Conference on Application of superabsorbent polymers and other new admixtures in concrete construction (2014), ISBN: 978-2-35158-147-6; e-ISBN: 978-2-35158-148-3; *Eds. Viktor Mechtcherine and Christof Schroeffl*

**PRO 96 (online version):** XIII DBMC: XIII International Conference on Durability of Building Materials and Components (2015), e-ISBN: 978-2-35158-149-0; *Eds. M. Quattrone and V. M. John*

**PRO 97:** SHCC3 – 3rd International RILEM Conference on Strain Hardening Cementitious Composites (2014), ISBN: 978-2-35158-150-6; e-ISBN: 978-2-35158-151-3; *Eds. E. Schlangen, M. G. Sierra Beltran, M. Lukovic and G. Ye*

**PRO 98:** FERRO-11 – 11th International Symposium on Ferrocement and 3rd ICTRC - International Conference on Textile Reinforced Concrete (2015), ISBN: 978-2-35158-152-0; e-ISBN: 978-2-35158-153-7; *Ed. W. Brameshuber*

**PRO 99 (online version):** ICBBM 2015 - 1st International Conference on Bio-Based Building Materials (2015), e-ISBN: 978-2-35158-154-4; *Eds. S. Amziane and M. Sonebi*

**PRO 100:** SCC16 - RILEM Self-Consolidating Concrete Conference (2016), ISBN: 978-2-35158-156-8; e-ISBN: 978-2-35158-157-5; *Ed. Kamal H. Kayat*

**PRO 101 (online version):** III Progress of Recycling in the Built Environment (2015), e-ISBN: 978-2-35158-158-2; *Eds. I. Martins, C. Ulsen and S. C. Angulo*

**PRO 102 (online version):** RILEM Conference on Microorganisms-Cementitious Materials Interactions (2016), e-ISBN: 978-2-35158-160-5; *Eds. Alexandra Bertron, Henk Jonkers and Virginie Wiktor*

**PRO 103 (online version):** ACESc'16 - Advances in Civil Engineering and Sustainable Construction (2016), e-ISBN: 978-2-35158-161-2; *Eds. T. Ch. Madhavi, G. Prabhakar, Santhosh Ram and P. M. Rameshwaran*

**PRO 104 (online version):** SSCS'2015 - Numerical Modeling - Strategies for Sustainable Concrete Structures (2015), e-ISBN: 978-2-35158-162-9

**PRO 105:** 1st International Conference on UHPC Materials and Structures (2016), ISBN: 978-2-35158-164-3, e-ISBN: 978-2-35158-165-0

**PRO 106:** AFGC-ACI-fib-RILEM International Conference on Ultra-High-Performance Fibre-Reinforced Concrete – UHPFRC 2017 (2017), ISBN: 978-2-35158-166-7, e-ISBN: 978-2-35158-167-4; *Eds. François Toutlemonde and Jacques Resplendino*

**PRO 107 (online version):** XIV DBMC – 14th International Conference on Durability of Building Materials and Components (2017), e-ISBN: 978-2-35158-159-9; *Eds. Geert De Schutter, Nele De Belie, Arnold Janssens and Nathan Van Den Bossche*

**PRO 108:** MSSCE 2016 - Innovation of Teaching in Materials and Structures (2016), ISBN: 978-2-35158-178-0, e-ISBN: 978-2-35158-179-7; *Ed. Per Goltermann*

**PRO 109 (2 volumes):** MSSCE 2016 - Service Life of Cement-Based Materials and Structures (2016), ISBN Vol. 1: 978-2-35158-170-4, Vol. 2: 978-2-35158-171-4, Set Vol. 1&2: 978-2-35158-172-8, e-ISBN : 978-2-35158-173-5; *Eds. Miguel Azenha, Ivan Gabrijel, Dirk Schlicke, Terje Kanstad and Ole Mejlhede Jensen*

**PRO 110:** MSSCE 2016 - Historical Masonry (2016), ISBN: 978-2-35158-178-0, e-ISBN: 978-2-35158-179-7; *Eds. Inge Rörig-Dalgaard and Ioannis Ioannou*

**PRO 111:** MSSCE 2016 - Electrochemistry in Civil Engineering (2016), ISBN: 978-2-35158-176-6, e-ISBN: 978-2-35158-177-3; *Ed. Lisbeth M. Ottosen*

**PRO 112:** MSSCE 2016 - Moisture in Materials and Structures (2016), ISBN: 978-2-35158-178-0, e-ISBN: 978-2-35158-179-7; *Eds. Kurt Kielsgaard Hansen, Carsten Rode and Lars-Olof Nilsson*

**PRO 113:** MSSCE 2016 - Concrete with Supplementary Cementitious Materials (2016), ISBN: 978-2-35158-178-0, e-ISBN: 978-2-35158-179-7; *Eds. Ole Mejlhede Jensen, Konstantin Kovler and Nele De Belie*

**PRO 114:** MSSCE 2016 - Frost Action in Concrete (2016), ISBN: 978-2-35158-182-7, e-ISBN: 978-2-35158-183-4; *Eds. Marianne Tange Hasholt, Katja Fridh and R. Doug Hooton*

**PRO 115:** MSSCE 2016 - Fresh Concrete (2016), ISBN: 978-2-35158-184-1, e-ISBN: 978-2-35158-185-8; *Eds. Lars N. Thrane, Claus Pade, Oldrich Svec and Nicolas Roussel*

**PRO 116:** BEFIB 2016 – 9th RILEM International Symposium on Fiber Reinforced Concrete (2016), ISBN: 978-2-35158-187-2, e-ISBN: 978-2-35158-186-5; *Eds. N. Banthia, M. di Prisco and S. Soleimani-Dashtaki*

**PRO 117:** 3rd International RILEM Conference on Microstructure Related Durability of Cementitious Composites (2016), ISBN: 978-2-35158-188-9, e-ISBN: 978-2-35158-189-6; *Eds. Changwen Miao, Wei Sun, Jiaping Liu, Huisu Chen, Guang Ye and Klaas van Breugel*

**PRO 118 (4 volumes):** International Conference on Advances in Construction Materials and Systems (2017), ISBN Set: 978-2-35158-190-2, Vol. 1: 978-2-35158-193-3, Vol. 2: 978-2-35158-194-0, Vol. 3: ISBN:978-2-35158-195-7, Vol. 4: ISBN:978-2-35158-196-4, e-ISBN: 978-2-35158-191-9; *Eds. Manu Santhanam, Ravindra Gettu, Radhakrishna G. Pillai and Sunitha K. Nayar*

**PRO 119 (online version):** ICBBM 2017 - Second International RILEM Conference on Bio-based Building Materials, (2017), e-ISBN: 978-2-35158-192-6; *Ed. Sofiane Amziane*

**PRO 120 (2 volumes):** EAC-02 - 2nd International RILEM/COST Conference on Early Age Cracking and Serviceability in Cement-based Materials and Structures, (2017), Vol. 1: 978-2-35158-199-5, Vol. 2: 978-2-35158-200-8, Set: 978-2-35158-197-1, e-ISBN: 978-2-35158-198-8; *Eds. Stéphanie Staquet and Dimitrios Aggelis*

**PRO 121 (2 volumes):** SynerCrete18: Interdisciplinary Approaches for Cement-based Materials and Structural Concrete: Synergizing Expertise and Bridging Scales of Space and Time, (2018), Set: 978-2-35158-202-2, Vol.1: 978-2-35158-211-4, Vol.2: 978-2-35158-212-1, e-ISBN: 978-2-35158-203-9; *Eds. Miguel Azenha, Dirk Schlicke, Farid Benboudjema and Agnieszka Knoppik*

**PRO 122:** SCC'2018 China - Fourth International Symposium on Design, Performance and Use of Self-Consolidating Concrete, (2018), ISBN: 978-2-35158-204-6, e-ISBN: 978-2-35158-205-3; *Eds. C. Shi, Z. Zhang and K. H. Khayat*

**PRO 123:** Final Conference of RILEM TC 253-MCI: Microorganisms-Cementitious Materials Interactions (2018), Set: 978-2-35158-207-7, Vol.1: 978-2-35158-209-1, Vol.2: 978-2-35158-210-7, e-ISBN: 978-2-35158-206-0; *Ed. Alexandra Bertron*

**PRO 124 (online version):** Fourth International Conference Progress of Recycling in the Built Environment (2018), e-ISBN: 978-2-35158-208-4; *Eds. Isabel M. Martins, Carina Ulsen and Yury Villagran*

**PRO 125 (online version):** SLD4 - 4th International Conference on Service Life Design for Infrastructures (2018), e-ISBN: 978-2-35158-213-8; *Eds. Guang Ye, Yong Yuan, Claudia Romero Rodriguez, Hongzhi Zhang and Branko Savija*

**PRO 126:** Workshop on Concrete Modelling and Material Behaviour in honor of Professor Klaas van Breugel (2018), ISBN: 978-2-35158-214-5, e-ISBN: 978-2-35158-215-2; *Ed. Guang Ye*

**PRO 127 (online version):** CONMOD2018 - Symposium on Concrete Modelling (2018), e-ISBN: 978-2-35158-216-9; *Eds. Erik Schlangen, Geert de Schutter, Branko Savija, Hongzhi Zhang and Claudia Romero Rodriguez*

**PRO 128:** SMSS2019 - International Conference on Sustainable Materials, Systems and Structures (2019), ISBN: 978-2-35158-217-6, e-ISBN: 978-2-35158-218-3

**PRO 129:** 2nd International Conference on UHPC Materials and Structures (UHPC2018-China), ISBN: 978-2-35158-219-0, e-ISBN: 978-2-35158-220-6;

**PRO 130:** 5th Historic Mortars Conference (2019), ISBN: 978-2-35158-221-3, e-ISBN: 978-2-35158-222-0; *Eds. José Ignacio Álvarez, José María Fernández, Iñigo Navarro, Adrián Durán and Rafael Sirera*

**PRO 131 (online version):** 3rd International Conference on Bio-Based Building Materials (ICBBM2019), e-ISBN: 978-2-35158-229-9; *Eds. Mohammed Sonebi, Sofiane Amziane and Jonathan Page*

## RILEM Reports (REP)

**Report 19:** Considerations for Use in Managing the Aging of Nuclear Power Plant Concrete Structures (ISBN: 2-912143-07-1); *Ed. D. J. Naus*

**Report 20:** Engineering and Transport Properties of the Interfacial Transition Zone in Cementitious Composites (ISBN: 2-912143-08-X); *Eds. M. G. Alexander, G. Arliguie, G. Ballivy, A. Bentur and J. Marchand*

**Report 21:** Durability of Building Sealants (ISBN: 2-912143-12-8); *Ed. A. T. Wolf*

**Report 22:** Sustainable Raw Materials - Construction and Demolition Waste (ISBN: 2-912143-17-9); *Eds. C. F. Hendriks and H. S. Pietersen*

**Report 23:** Self-Compacting Concrete state-of-the-art report (ISBN: 2-912143-23-3); *Eds. Å. Skarendahl and Ö. Petersson*

**Report 24:** Workability and Rheology of Fresh Concrete: Compendium of Tests (ISBN: 2-912143-32-2); *Eds. P. J. M. Bartos, M. Sonebi and A. K. Tamimi*

**Report 25:** Early Age Cracking in Cementitious Systems (ISBN: 2-912143-33-0); *Ed. A. Bentur*

**Report 26:** Towards Sustainable Roofing (Joint Committee CIB/RILEM) (CD 07) (e-ISBN 978-2-912143-65-5); *Eds. Thomas W. Hutchinson and Keith Roberts*

**Report 27:** Condition Assessment of Roofs (Joint Committee CIB/RILEM) (CD 08) (e-ISBN 978-2-912143-66-2); *Ed. CIB W 83/RILEM TC166-RMS*

**Report 28:** Final report of RILEM TC 167-COM 'Characterisation of Old Mortars with Respect to Their Repair (ISBN: 978-2-912143-56-3); *Eds. C. Groot, G. Ashall and J. Hughes*

**Report 29:** Pavement Performance Prediction and Evaluation (PPPE): Interlaboratory Tests (e-ISBN: 2-912143-68-3); *Eds. M. Partl and H. Piber*

**Report 30:** Final Report of RILEM TC 198-URM 'Use of Recycled Materials' (ISBN: 2-912143-82-9; e-ISBN: 2-912143-69-1); *Eds. Ch. F. Hendriks, G. M. T. Janssen and E. Vázquez*

**Report 31:** Final Report of RILEM TC 185-ATC 'Advanced testing of cement-based materials during setting and hardening' (ISBN: 2-912143-81-0; e-ISBN: 2-912143-70-5); *Eds. H. W. Reinhardt and C. U. Grosse*

**Report 32:** Probabilistic Assessment of Existing Structures. A JCSS publication (ISBN 2-912143-24-1); *Ed. D. Diamantidis*

**Report 33:** State-of-the-Art Report of RILEM Technical Committee TC 184-IFE 'Industrial Floors' (ISBN 2-35158-006-0); *Ed. P. Seidler*