

## Report

### SARCOS COST – RILEM Doctoral Course

#### *Advanced materials and technologies based on inorganic binders*

*Ss Cyril and Methodius University in Skopje, Faculty of Technology and Metallurgy, Skopje, 2-5 Sept. & Ohrid 6-7 Sept. 2018, Republic of Macedonia*

**Organized by:** *Konstantin Kovler; Ole Mejlhede Jensen; Nele De Belie; Emilija Fidanchevski*

### Participants:

A total of 33 PhD students and early career investigators from 15 countries participated in the doctoral course where the Faculty of technology and metallurgy in the frame of Ss Cyril and Methodius University in Skopje was the host institution and local organizer. The Institute of Earthquake Engineering and Engineering Seismology (IZIIS) from Ss Cyril and Methodius University in Skopje, Institute for testing materials and development of new technologies (ZIM "Skopje" AD Skopje) and Cementarnica USJE AD Skopje – TITAN Group were the domestic partner institutions supporting the doctoral course activities where hands-on laboratory exercises were performed. KNAUF-Radika from Debar was the host for a professional tour.



*Participants, teachers and organizational team of the SARCOS COST-RILEM Doctoral Course*

### Scope of course:

The course enriched the participants with up-to-date knowledge on advanced materials and technologies related to inorganic binders. Self-healing of materials, role of nanomaterials, modern uses of composites, sustainability and safety requirements for the use of inorganic materials in construction were the topics addressed. The students shared their recent research results and participated in the laboratory works.

### Course content:

The course consisted of lectures, hands-on laboratory exercises, poster presentations and a "conference presentation" session. In addition, the doctoral course included a professional tour to the company KNAUF-Radika in Debar where the participants visited the most attractive gypsum deposit and the production process of some KNAUF gypsum products. The planned social activities realized the aim to stimulate a friendly study atmosphere. The lecture plan follows at the end of this report.



Part of laboratory work and professional tour to KNAUF-Radika in Debar

### **Financial and scientific support:**

The SARCOS COST – RILEM Doctorate Course was financed from COST Action CA15202, and RILEM provided a scientific sponsorship. The course was also co-sponsored from the domestic institutions: Ss Cyril and Methodius University in Skopje, Cementarnica USJE - TITAN Group and KNAUF – Macedonia. Also, local food companies supported the event, which was mentioned at the course and in the folder for detailed plan of activities. Information about RILEM was presented to the participants. This included sign-up for the 3-years free RILEM membership for the PhD-students.

### **Lecturers:**

The following persons lectured at the course:

- Konstantin Kovler, Technion - Israel Institute of Technology, Haifa, Israel
- Ole Mejlhede Jensen, Technical University of Denmark, Lyngby, Denmark
- Nele De Belie, Ghent University, Ghent, Belgium
- Liberato Ferrara, Politecnico di Milano, Milano, Italy
- Henk Jonkers, Delft University of Technology, Delft, Netherlands
- Jonjaua Ranogajec, University of Novi Sad, Novi Sad, Serbia
- Alva Peled University of Negev, Beer-Sheva, Israel
- Veronika Shendova, Ss Cyril and Methodius University in Skopje, Republic of Macedonia
- Emilija Fidanchevski, Ss Cyril and Methodius University in Skopje, Republic of Macedonia

### **Workload, ECTS and learning outcomes:**

The work load of the full course was approximately 140 hours corresponding to 5 ECTS points, including the teaching period during the course, readings before the course preparation of personal presentation, and completion of individual posters. The learning outcomes of the participants were evaluated mainly through the individual poster and the plenum presentations finalizing the course. A certificate of attendance was issued to the participants completing the course. Seven participants were awarded poster competition prizes:

#### **Technical content:**

Gold prize: Tim Van Mullem, Ghent University, Ghent, Belgium

Silver prize: Evangelia Tsampali, Aristotle University of Thessaloniki, Thessaloniki, Greece

Bronze prize: João Almeida, University of Minho, Guimaraes, Portugal

#### **Technical Format:**

Gold prize: J.A. Canul-Polanco, Technical University of Denmark, Lyngby, Denmark

Silver prize: Amer Aletawna, University of Negev, Beer-Sheva, Israel

Bronze prize: Volodymyr Kyrychok, Kiev National University for Construction, Kiev, Ukraine

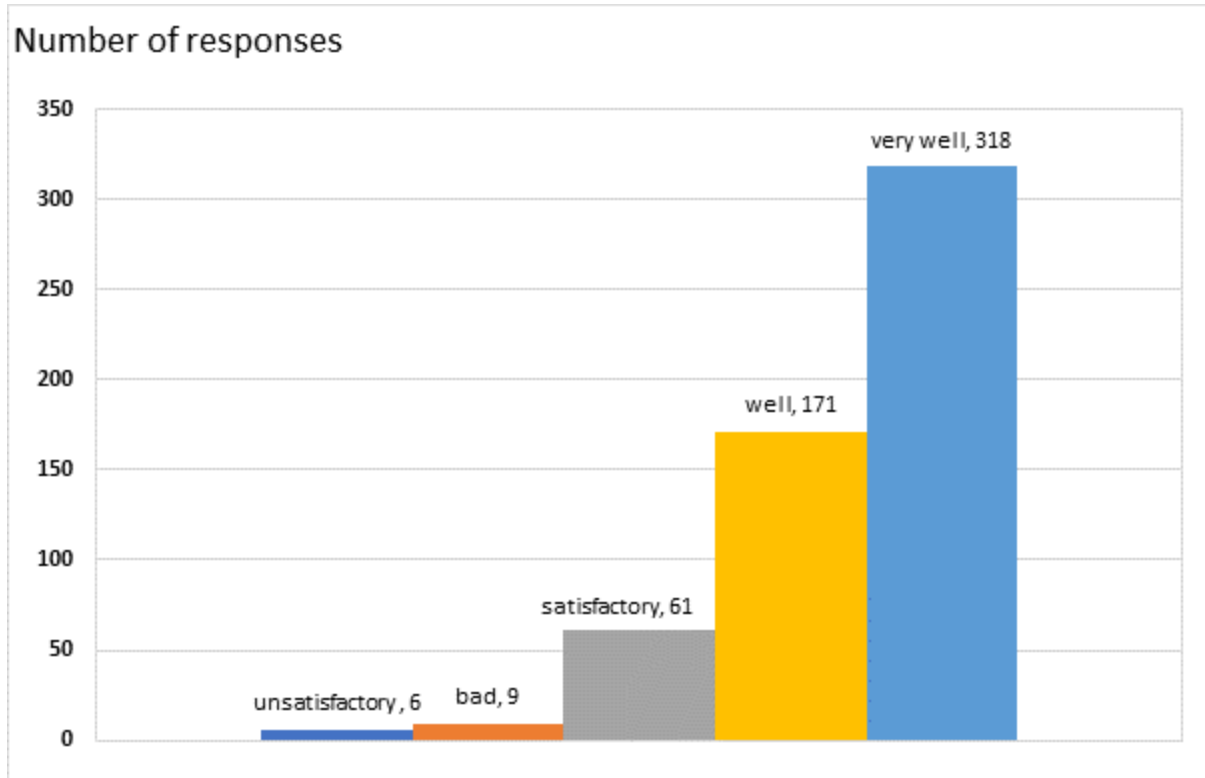
**Trainee prize:** Estefania Cuenca, Politecnico di Milano, Milano, Italy



Happy poster competition prize winners

### Course evaluation:

At the end of the course the evaluation was conducted. A total of 24 participants completed the questionnaire which dealt with every segment of the course. On the scale "unsatisfactory, bad, satisfactory, well and very well", far the majority of responses were well or very well. Many participants expressed spontaneously that they found the course very good and useful for their future research career.





### **Some of the participant comments:**

*"First of all I want to ensure that the organization of this training school has been absolutely excellent. The schedule was always maintained. The lessons were carried on by experts on the topic."*

*Anonymous*

*"Very interesting course and useful for my research, It was a practice course which make this course different and good; The course very well organized and the techniques of responsible persons from Skopje was very helpful."*

*Anonymous*

*"All trainees of the training school were welcomed by a very motivated and prepared team. This motivation was the key to making the training school an excellent place to meet international colleagues, aside from learning a ton of new stuff."*

*Tim Vam Mulle winner of  
the first price for Technical  
content*

*"I can only say positive things about the 2nd training School in Macedonia. Interesting readings, knowledge of professionals from different countries, exchange of ideas, etc. All with one common goal: To improve and advance research. "*

*Ruben Beltran Cobos*

### **Some comments from the organizers:**

*"A PhD course provides to students the ideal opportunity to learn from experts in the field, to build a scientific network and to get hands-on experience during lab sessions. The SARCOS training school organized in Skopje and Ohrid reached these goals perfectly. In addition the hosts introduced the students and trainers to their beautiful country with the greatest possible hospitality."*

*Nele De Belie*

*"It has been a fantastic week in Macedonia for trainers and trainees to participate in this doctoral course perfectly hosted by the Faculty of Technology and Metallurgy at the Ss. Cyril and Methodius University. Such an event constitutes a unique possibility to provide effective, high-level knowledge transfer, to establish personal and professional contacts, and also to learn to understand the qualities within different scientific cultures."*

*Ole Mejlhede Jensen*

*"The school was perfectly prepared through the strong cooperation between the host university with SARCOS COST and RILEM and thanks to the scientific sponsorship of the two last international associations. The school involved lectures delivered by leading experts. The program was rich and incorporated different teaching elements: preparatory readings, exercises, laboratory exercises, report writing, posters, conference presentations, a study tour to gypsum mine and factory (Knauf Debar), and numerous social activities, which created a friendly and stimulating study atmosphere. The local organizers gained an important experience which can help in organizing bigger*

international events in Macedonia and expose the local research and professional infrastructure in the international scale."

Konstantin Kovler

Based on the responses received through the questionnaires and personal contacts during and after the course it is concluded that the event was very successful.

Organizers of the doctorate course: Konstantin Kovler; Ole Mejlhede Jensen; Nele De Belie; Emilija Fidanchevski

## Appendix: Lecture plan

Advanced materials and technologies based on inorganic binders

	Sunday, 2 <sup>nd</sup> Sept.	Monday, 3 <sup>rd</sup> Sept.	Tuesday, 4 <sup>th</sup> Sept.	Wednesday, 5 <sup>th</sup> Sept.	Thursday, 6 <sup>th</sup> Sept.		Friday, 7 <sup>th</sup> Sept.	
9.00-9.40		Lecture 1 – KK <i>Inorganic binders: historical development, manufacture, composition and properties</i>	Lecture 5 – OM <i>The state of water in inorganic binders – Powers' model</i>	Lecture 9 – OM <i>Control of water in inorganic binders – SAP</i>	7.30-8.00	Starting professional tour to KNAUF RADIKA DEBAR	8.30-12.30	Preparation of student presentations
9.50-10.30		Lecture 2 – NDB <i>Supplementary cementitious materials</i>	Lecture 6 – NDB <i>Self-healing of cementitious materials</i>	Lecture 10 – HJ <i>Development, application and valorization of bacteria-based self-healing concrete</i>	11.00-11.30	Lecture 14- BM, KK <i>Gypsum products</i>	12.30-14.30	Students presentations
10.30-11.00		Coffee break	Coffee break	Coffee break	11.30-14.30	Visiting KNAUF factory and underground historical quarry, BM, BA  Lunch  Departure to Ohrid	14.30-15.00	Closing Training School
11.00-11.40	Lecture 3 – LF <i>Self-healing of lime mortars</i>	Lecture 7 – AP <i>Nanofillers in cement based composites</i>	Lecture 11 – LF <i>ECCs/HPFRCCs</i>	11.00-11.30	14.30-15.30		15.00-16.30	
11.50-12.30	Lecture 4 – JR <i>Autogenous self-healing of historical binders</i>	Lecture 8 – KK <i>Gypsum and its uses in construction</i>	Lecture 12 – VS <i>Advanced composites in earthquake engineering</i>	11.30-12.00	15.30-17.00			
12.30-13.30		Lunch	Lunch	Lunch				
13.30-14.00		Departure to the factory/institutes	Departure to the factory/institutes	Departure to the factory/institutes				
14.00-17.00	Registration	Laboratory work and introduction of the institutes/factory	Laboratory work and introduction of the institutes/factory	Laboratory work and introduction of the institutes/factory	17.00	Accommodation in Ohrid	16.30-19.30	Sightseeing the old part of Ohrid
17.00-20.00	Opening Training School	Departure to the town center	Departure to the town center	Departure to the town center				
20.00-22.30	Welcome dinner	Sightseeing - facultative	Sightseeing - facultative	Free evening	19.00	Dinner in Ohrid	19.30	Free evening

Trainers: KK – Konstantin Kovler; OM – Ole Mejlhede Jensen; NDB – Nele De Belie; LF - Liberato Ferrara; JR- Jonjaua Ranogajec; AP – Alva Peled; HJ – Henk Jonkers; VS - Veronika Shendova; BM – Burhan Murati; BA – Biljana Angjusheva; EF – Emilija Fidanchevski.