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yCAM 2019

Conference Abstracts

young Ceramists Additive Manufacturing Forum

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Université de Mons - Mons, Belgium

Editors

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The **young Ceramists Additive Manufacturing Forum (yCAM)** is a conference and networking platform organized by **Europe Makes Ceramics (EMC)** and supported by **European Ceramic Society (ECerS)** and **JECS Trust**.

The **yCAM** conference is dedicated to young scientists who are developing a career in the field of additive manufacturing of ceramics or are entering this topic.

yCAM covers the main AM technologies applied to ceramics and in particular the following topics:

Technologies:

- Robocasting / Direct ink writing
- Stereolithography
- Powder-based 3D Printing
- Selective laser sintering/melting
- Direct inkjet printing
- Laminated object manufacturing
- Novel Additive Manufacturing technologies

Additive Manufacturing materials and technologies:

- Silicate ceramics, pottery, ceramic art and architecture
- Technical ceramics and advanced applications: bioceramics, porous ceramics, piezoelectric ceramics, printed circuits etc.
- Composites and multi-material Additive Manufacturing

Design and software

Innovative and process-driven design

Software and data preparation for Additive Manufacturing

yCAM in the past

The first **yCAM 2017** conference was held in Berlin at the **Chair of Advanced Ceramic Materials of Technical University Berlin**:

The young Ceramists Additive Manufacturing Forum (yCAM) took place on March 23-24 2017 in Berlin, Germany. The conference has been hosted by the Technical University Berlin, Fachgebiet Keramische Werkstoffe.

yCAM 2017 had a very positive response of international participation, with 63 registered participants coming from institutions situated in 11 different European countries and guests from Iraq and China. Two keynote presentations from senior researchers were delivered by Dr. Martin Schwentenwein (Lithoz company, Austria) and Dr. Fabrice Rossignol (CEC Limoges, France). The major part of the program, split over 4 sessions in two days, included 20 presentations from young scientists. In addition, the participants enjoyed the possibility of taking part in the conference dinner on the evening of March 23rd and in the visit to 3D Lab at the Technical University of Berlin.

The second **yCAM 2018** took place in Padua and was sponsored by the **JECS Trust** and by **La Società Ceramica Italiana (ICerS)** **yCAM 2018** was patrocinated by the **University of Padova and the Industrial Engineering Department**.

yCAM 2018 had a very positive response of international participation with almost 100 registered participants coming from institutions situated in 19 different countries. Four keynote presentations from senior researchers were delivered by Prof. E. Saiz (Imperial College, UK), Prof. G. Bertrand (CIRIMAT, France), Dr. R. Gaignon (3DCERAM, France) and Dr. E. Mancuso (Ulster University, UK). The major part of the program, split over 8 sessions in two days, included 28 presentations from young scientists. In addition, the participants enjoyed the possibility of taking part in the conference dinner on the evening of May 3rd and a visit to MUSME (Museum of History of Medicine in Padova).

yCAM 2019 session chairs

yCAM aims to cover all technologies involved with AM of ceramics. yCAM 2019 is organised in 5 different sessions that are chaired by dedicated researchers from the specific fields:

- **3D Printing – direct**

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- **3D Printing - powder based, indirect**

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- **Stereolithography**

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- **Robocasting and Fused Deposition Modeling**

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- **Selective Laser Sintering/Melting**

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Macroporous composites with a complex framework based on calcium phosphate and biodegradable biopolymers

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Abstract

Modern regenerative medicine has a need in resorbable biocomposites as bone implants. Biodegradable polymers (polyc(ε-caprolactone) (PCL), poly(D,L-lactide) (PLA)) filled with resorbable calcium phosphates (with the ratio Ca/P ≤ 1.5, e.g., amorphous (ACP), mixed-anionic (maACP) and tricalcium phosphates (β-TCP)) can serve as such implants. Imperative feature of the materials is specific macroporous architecture (osteoconductivity) created by 3D-printing. In the case of thermal extrusion technique of 3D-printing (or, fused deposition modeling – FDM™), it is necessary to fabricate composite cords with uniform distribution of phosphate particles inside thermoplastic prior, to elaborate printing regimes, as well. The main goal is the development of such prototypes. Tasks include synthesis and physico-chemical studies of required calcium phosphates, 3D-printing of biocomposites β-TCP/(PCL,PLA), and modification of the composite surface. Determination the optimal parameters of 3D-printing technology for obtaining complex structures is important, as well. Composite β-TCP/PCL cords with different ratios (23% and 46%, 50% and 70%) β-TCP and with the different binding agent (vaseline oil and ethyl alcohol, respectively), as well as, β-TCP/PLA (20% and 50%) cords were formed. Macroporous structures with sizes of cells 16.5 × 16.5 × 4.5 mm; 30 × 30 × 3.5 mm, 10 × 10 × 2 mm, as well as, implants of a more complex shape with the Kelvin structure were produced by FDM printing. A change in the hydrophilicity of the surface of the obtained composite was demonstrated both by plasma treatment (500 V, 5 mA, AC, 5–15 minutes), and by soaking in 5-SBF solution, as well as, their combination. Thus, bioactive macroporous composites based on calcium phosphates and biopolymers were obtained. The possibility of obtaining osteoconductive implants based on polymers filled with resorbable calcium phosphate using thermal extrusion 3D printing has been shown.

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Topic Areas

Fused Deposition Modeling

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