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# yCAM 2019

Conference Abstracts

young Ceramists Additive Manufacturing Forum

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Editors

David Karl, Giorgia Franchin, Andrea Zocca

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).

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# Calcium magnesium phosphates ceramics for bone regeneration

## Authors

Ms. Gilyana Kazakova - Lomonosov Moscow State University

Dr. Tatiana Safronova - Lomonosov Moscow State University

Prof. Valery Putlayev - Lomonosov Moscow State University

Prof. Irina Selezneva - Institute of Theoretical and Experimental Biophysics

## Abstract

The implant cytotoxicity and sufficient porosity to allow the growth of blood vessels, nerve tissue and bone cells proliferation need to be taken into consideration for regeneration of bone tissue in reconstructive and corrective surgery and orthopedics. Furthermore, bone remodeling process depends on complex signaling pathway between osteoblasts and osteoclasts and control mechanisms to achieve homeostasis of their growth and differentiation. Considering the inorganic part of human bone is mainly composed of hydroxyapatite (HAP:  $\text{Ca}_{10}(\text{PO}_4)_6(\text{OH})_2$ ) and whitlockite (WH:  $\text{Ca}_{18}\text{Mg}_2(\text{HPO}_4)_2(\text{PO}_4)_{12}$ ) minerals, where the WH phase occupies up to 20–35% of total weight and it can recapitulate early-stage of bone regeneration through stimulating osteogenic differentiation, prohibiting osteoclastic activity, and transforming into mechanically enhanced hydroxyapatite (HAP)-neo bone tissues by continuous supply of  $\text{PO}_4^{3-}$  and  $\text{Mg}^{2+}$  under physiological conditions. In this study, we are obtaining porous resorbable ceramic materials based on calcium magnesium phosphates. Such materials According to the laser granulometry of calcium magnesium phosphate, the nanoparticle are suitable for 3D printing where they have a dark gray color, due to the presence of decomposition products of ammonium acetate. The resulting composite (monomers / powder) structures in the form of a Kelvin structure were exposed to a temperature of up to 1200°C. The study of the metabolic activity of cells in the presence of extracts from the material showed that the materials are able to support the adhesion, spreading and proliferative activity of human mesenchymal stem cells. These samples of biomaterials are biocompatible and do not have a cytotoxic effect on mammalian cells. The resulting ceramic materials are suitable for the creation of resorbable bone implants, including individually designed inorganics bases for the treatment of bone defects.

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## Topic Areas

Stereolithography

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