3D printing and additive manufacturing (May 21st – 22nd, 2021 Paris, France)

Additive Manufacturing and Catalysis: a powerful synergy to boost the chemical industry in the 21st century

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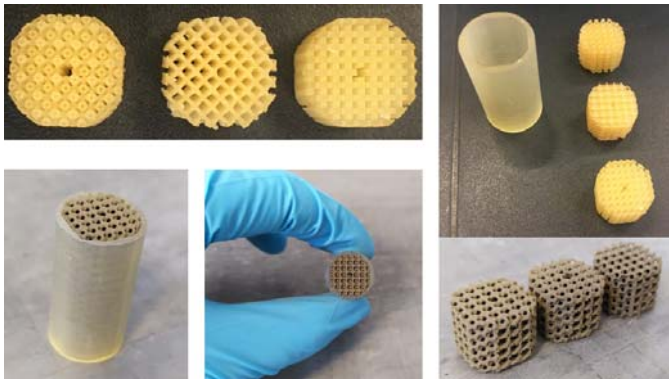
Abstract (300 word limit)

Catalysis is one of the pillars of the chemical industry that has promoted its evolution since the 20th century, and currently it is one of the fields of study where new routes to consolidate new sources of renewable energy and strategies to curb climate change and the emission of greenhouse gases are being studied in depth. For the achievement of these goals, catalysis must be modernized through the implementation of new manufacturing tools such as additive manufacturing, which is one of the key elements of the new industrial revolution "Industry 4.0".

The appearance of additive manufacturing dates back to the 80s, but its application in catalysis has only begun to be appreciated in the last decade. The growth of research that address this combination is exponential and this has brought about the birth of a special field of research, in which there are different strategies used to obtain devices with catalytic properties. Therefore, it is necessary to thoroughly evaluate as much as possible of what work has been done to date in order to establish trends in this field, recognize their strengths, weaknesses and future prospects. Furthermore, it is important to identify and define concepts that allow understanding the strategies that are being followed to incorporate 3D printing with catalysis.

This keynote presents an in-depth analysis of this promising fusion between these technological fields, including a complete description of the milestones of additive manufacturing and the principles of the technologies used, as well as the scenario that has given rise to such combination. Moreover, the most used printing techniques, materials and manufacturing procedures for obtaining catalytic devices will be analyzed. In addition, a short- and medium-term scenario will be shown, in which the main challenges that are currently being worked intensively will be analyzed.

Figure 3D Printed Periodic Open Cell Structures (POCS) used as catalytic supports (Printed by O.H. Laguna and coworkers in the University of Jaén)



Recent Publications

1. C. Parra-Cabrera, C. Achille, S. Kuhn, R. Ameloot, 3D printing in chemical engineering and catalytic technology: structured catalysts, mixers and reactors, Chem. Soc. Rev., 47 (2018) 209-230.
2. C. Hurt, M. Brandt, S.S. Priya, T. Bhatelia, J. Patel, P.R. Selvakannan, S. Bhargava. Catal. Sci. Tech., 7 (2017) 3421-3439
3. M. Bracconi, M. Ambrosetti, O. Okafor, V. Sans, X. Zhang, X. Ou, C.P. Da Fonte, X. Fan, M. Maestri, G. Groppi, E. Tronconi, Investigation of pressure drop in 3D replicated open-cell foams: Coupling CFD with experimental data on additively manufactured foams, Chemical Engineering Journal, 377 (2019) 120123.
   S. Danaci, L. Protasova, V. Middelkoop, N. Ray, M. Jouve, A. Bengaouer, P. Marty, Scaling up of 3D printed and Ni/Al2O3 coated reactors for CO2 methanation, Reaction Chemistry & Engineering, 4 (2019) 1318-1330..
5. J. An, J.E.M. Teoh, R. Suntornnond, C.K. Chua, Design and 3D Printing of Scaffolds and Tissues, Engineering, 1 (2015) 261-268..



O.H. Laguna's Biography (150 word limit)

Oscar H. Laguna, a Postdoctoral Research Associate of the University of Jaén (Spain), has his expertise in Heterogeneous Catalysis and Materials Science. His research has focused on developing catalytic applications based on microreactor-type structures. These devices can be applied to different reactions such as hydrogen purification, WGS reaction and CO2 methanation. He recently works on the application of 3D printing in the manufacture of these catalytic devices, since through advanced design the properties of these can be promoted. For structured catalyst printing, he explores both catalytic materials and substrate printing materials. Regarding the designs generated by CAD tools, he analyzes honeycomb monoliths and foams with regular structures such as Periodic Open Cell Structures (POCS).

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