

# 1st National Congress of the Mexican Society of Synchrotron Light & 1st International Congress of Synchrotron Light Techniques



Contribution ID : 15

Type : **Presentation**

## TRENDS ON THE MICROSTRUCTURE AND PATHOLOGY OF CONCRETE RESEARCH WITH SYNCHROTRON RADIATION

Thursday, 24 June 2021 12:30 (1:00)

### Abstract

At present, the construction industry has a big challenge in favor of the environment, having among other objectives, reduce CO<sub>2</sub> emissions, construction waste, and the use of natural aggregates. Therefore, to improve the durability and longevity of concrete, sustainably, conventional techniques are often used to analyze and characterize cementitious materials, aggregates, additives and admixtures, to explore the morphology, composition, and crystalline structure of the materials, and the composites used in construction. However, in the last decade, techniques based on synchrotron radiation (SR) are elucidating the interaction of such materials in more detail, thanks to their high spectral and spatial resolution. Techniques, such as Scanning Transmission X-ray Microscopy (STXM), microtomography ( $\mu$ CT), high-pressure X-ray diffraction (XRD), among others; are making it possible to investigate deeper and efficiently the microstructure of cementitious mixtures, the phenomenon of hydration, crystallization, polymerization. Besides, it is becoming easier to visualize and analyze the generation and distribution of pores; the interaction of additives, and admixtures in the cementitious matrix. And lately, the effect of solid waste (crushed glass and concrete) used as aggregates. On the other hand, pathologies due to aggregate reactivity, chloride, sulfate, CO<sub>2</sub>, and other aggressive elements to the construction components, can be studied as well. Overall, the studies performed with SR techniques are contributing greatly to the knowledge of deterioration processes and the pathologies in mortars, concrete, and edifications, and are helping to improve the durability and longevity of buildings sustainably.

### About

El Dr. Daniel Hernández Cruz es Profesor Tiempo Completo de la Facultad de Ingeniería de la Universidad Autónoma de Chiapas. Es Ingeniero Electrónico por Instituto Tecnológico de Tuxtla (ITTG). Obtuvo el grado Maestro en Ciencias con la Especialidad en Óptica por el Instituto Nacional de Astrofísica, Óptica y Electrónica (INAOE). Es Doctor en Física por la Université Laval, de Quebec, Canadá, en el año 2004. Del año 2004 al 2007 realizó trabajos de investigación como Posdoctorante para McMaster University en Ontario, Canadá, estando de base en el Advanced Light Source del Lawrence Berkeley National Laboratory, en California, Estados Unidos. Entre los años 2007 y 2008 realizó, como posdoctorante, trabajos de investigación con el grupo de Nanociencias y Nanotecnología en el Instituto Potosino de Investigación Científica y Tecnológica (IPICYT). Del 2008 al 2009 se incorporó a la Facultad de Ingeniería de la UNACH para realizar investigaciones bajo el programa de retención de CONACYT. Entre el 2012 y 2013 realizó una estancia de investigación como profesor invitado del Prof. Paulo Monteiro, del Departamento de Ing. Civil y Ambiental de la Universidad de California en Berkeley, EEUU, utilizando técnicas basadas en Luz de Radiación Sincrotrón, para el estudio de materiales cementosos.

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**Session Classification :** Guest Lecture