北海道大学
HOKKAIDO UNIVERSITY

Takafumi Sugiyama
Ph.D., P.E.Jp(Ci)

Takafumi Sugiyama is a Professor of the Environmental Material Engineering Laboratory, Faculty of Engineering, Hokkaido University. Prof. Sugiyama's research efforts are concentrated in the field of civil engineering, with a focus on enhanced performance of construction materials, supplementary cementitious materials and quality assessment of structural concretes. He earned his Ph.D. from the University of New Brunswick, Canada, in 1994. Before joining the faculty of Hokkaido University in 2006, Prof. Sugiyama was involved in research and education at Gunma University in Gunma Prefecture, Japan. He has published his paper in international journals such as Cement and Concrete Research, Journal of Advanced Concrete Technology, Magazine of Concrete Research, Construction and Building Materials, ACI Materials Journal, Materials etc. and made numerous presentations in international conferences. Prof. Sugiyama had been active in the establishment and revision of various standards and specifications, such as the Japan Society of Civil Engineers (JSCE) Standard Specification for Concrete Structures [Design], [Materials and Construction] and [Maintenance]. Prof. Sugiyama is a past member of the board of directors in the Japan Concrete Institute (JCI) and of the Technical Board Chairman in the Asian Concrete Federation (ACF). Prof. Sugiyama has been presented with many awards, such as the Best Paper Award of the Japan Cement Association (JCA) in 2003 and 2013, and the Japan Concrete Institute Award (Best Paper Award) in 2006 and 2014. In 2019 Prof. Sugiyama was awarded with Meritorious Deed Prize by Japan Concrete Institute. Finally, he has also served on several regional and national committees, such as the Hokkaido Regional Development Bureau of Ministry of Land, Infrastructure, Transport and Tourism (MLIT), Hokkaido Government and East Nippon Expressway Company Ld. (NEXCO-East). Prof. Sugiyama currently serves as a Chairman of Concrete Research Committee in Association for Civil Engineering Technology of Hokkaido.

Recent research topics:

/ Investigation of enhanced performance of concrete structures in snowy cold regions, marine /salt-laden environments and extremely harsh environments.
/ Development and application of high-quality X-ray technique for cement science and concrete technology
/ Exploration of innovated construction materials with new inclusions
/ Use of supplementary cementitious materials from viewpoints of environmental aspects and enhanced concrete properties

Environmental Material Engineering Laboratory

Division of Civil Engineering
Faculty of Engineering, Hokkaido University

Professor: Dr. Takafumi Sugiyama, PE

Focus Area of Research

The Environmental Material Engineering (EME) Laboratory has been carrying out research on concrete science and technology at Hokkaido University for more than 80 years. Recent research topics are as follows;

1 Characterization of hydrated cement system
- a. Exploration, alteration and degradation
- b. Effect of mineral additives of pozzolans and patent hydraulic materials

2 Development of innovative diagnosis with X-ray technology
- a Non-Destructive Integrated CT and XRD Method
- b Synchrotron/Microforcus X-ray CT

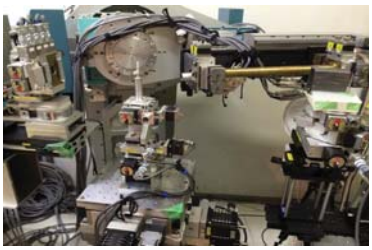
3 Corrosion of steel reinforcement in low carbon cementitious materials
- a Diagnosis for corrosion of steel arranged in multiple layers
- b Effect of crack and self-healing on propagation of corrosion

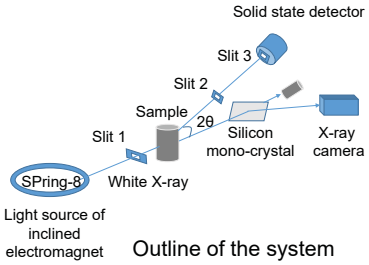
4 Clarification of damage mechanism under high/low temperatures
- a Effect of elevated temperatures for long time
- b Repeated freeze/thaw actions

5 Development of sustainable cementitious materials
- a Social, economical and technical aspects
- b Cooperative Social Responsibility (CSR) in construction industry

Non-Destructive Integrated CT-XRD Method

This innovative method developed by Prof. Sugiyama`s group allows to obtain CT image and XRD data at the required area. Based on CT image regions of interest are specified followed by the measurement of XRD. The white X-ray is transmitted and diffraction is captured at a fixed angle(2θ). This operation is conducted without crashing specimen and data can be obtained over time.

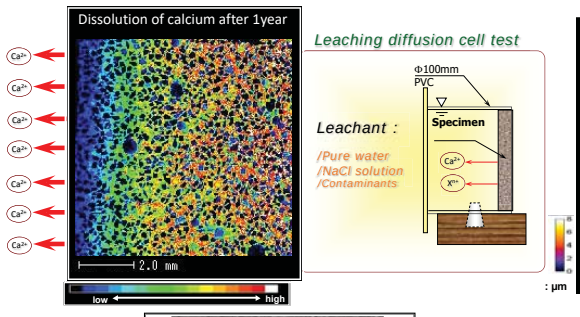


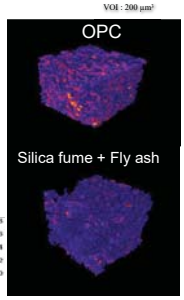


Outline of the system

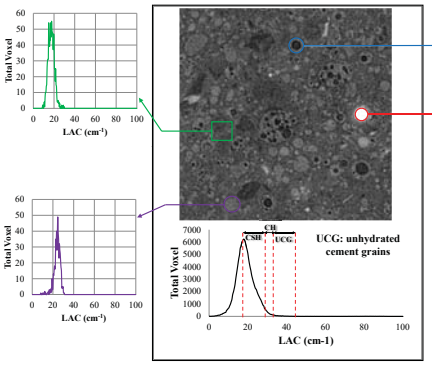
Low carbon high performance concrete

Characterization of low carbon high performance concrete (LCHPC) is investigated for long term durability by X-ray technology. Low alkali nature is also beneficial for the reduction of alkali attack to neighbors.





Increased pores due to electrical leaching migration test are reduced for LCHPC as compared with OPC concrete.

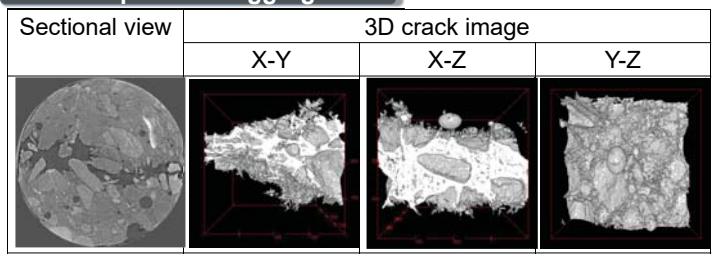


Linear attenuation coefficients by Synchrotron XRCT indicate the distribution of substances such as hydration products, un-hydrated cement grains, fly ash particles and so on in LCHPC.

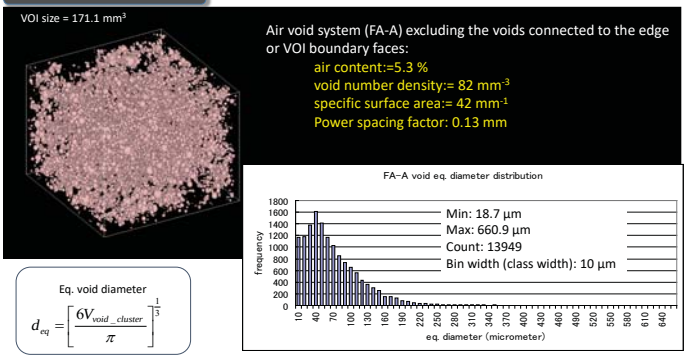
3D Visualization and quantification

Cutting edge technology to visualize microstructures and inclusions in concrete has been developed. Crack geometry, air void system, aggregates, transport and deformed steel bar are visualized and quantified.

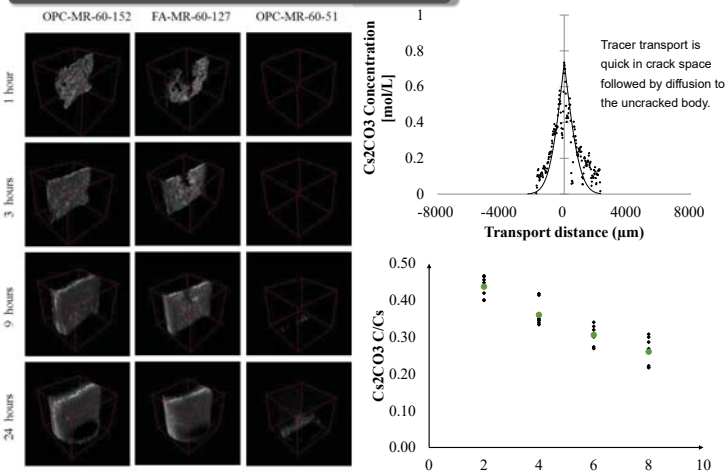
Crack space and aggregates



Entrained air



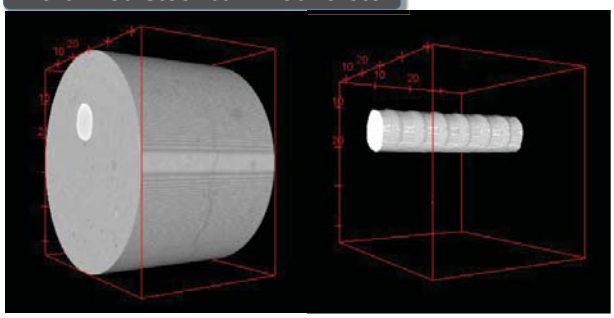
Transport through crack in concrete



Cesium carbonate solution as tracer transports within crack space. Less amount and distance for narrow crack

Profile of the content of cesium carbonate

Deformed steel bar in concrete



Deformed steel bar with the diameter of 10mm specified in JIS G3112 is visualized

Reference and Further information

(1)Takafumi Sugiyama and Michael Angelo B. Promentilla, Advancing Concrete Durability Research through X-ray Computed Tomography, Vol.19 Issue 6, pp. 730-755, 2021, DOI https://doi.org/10.3151/jact.19.730, (2)M. A. B. Promentilla *et al.*, *J. of Advanced Concrete Technology*, Vol.6, No.2, pp.273-286, 2008, (3) M. A.B. Promentilla *et al.*, *Cement and Concrete Research*, Vol.39, pp.548-557, 2009, (4) T. Sugiyama *et al. Cement and Concrete Research*, Vol.40, pp.1265-1270, 2010, (5) M.A.B. Promentilla and T. Sugiyama, *Journal of Advanced Concrete Technology*, Vol.8, No.2, pp.97-111, 2010, (6) I.S. Darma et al. J. of Advanced Concrete Technology, Vol. 11, No. 10 p. 266-281, 2013, (7) M. Henry *et al.*, *Construction and Building Materials*, 67, 37–46, 2014, (8) I. Zafar et al., *Magazine of Concrete Research*, 66(20), 1051-1064, 2014, (9) Henry, M. *et al.*, *Journal of Advanced Concrete Technology*, Vol. 14, pp. 134-143, 2015, (10) M.A.B. Promentilla *et al.*, *Materials*, 9(5), 388, 2016.

For further information:
https://concrete.eng.hokudai.ac.jp/