

# ADVANCES IN USE OF NANOMATERIALS AS FUNCTIONAL ADDITIVES IN ULTRA-HIGH PERFORMANCE CONCRETE

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## ABSTRACT

This paper will presents a state-of-the-art review of the functional utilization of nanomaterials in ultra-high-performance concrete (UHPC). First, we'll review the various types of nanomaterials currently available for use in UHPC. Their geometrical and physical roperties will be summarized. Next, the effects of nanomaterials on the packing density and fresh properties of UHPC will be enumerated. The hydration kinetics and mechanical properties of UHPC, such as the interfacial bonding, compressive strength, tensile and flexural responses, and nano-mechanical properties, will then be described according to the nanomaterial type and dosage. The paper will strive to provide insights into optimal dosages of nanomaterials required for strength enhancements of UHPC.

Given the focus of this ACF conference, the influence of nanomaterials on the durability-related properties, such as the porosity, water sorptivity and permeability, sulfate attack, abrasion resistance, corrosion resistance, freeze–thaw resistance, fatigue performance, and shrinkage, will then be thoroughly discussed.

Finally, nanomaterial-based functional UHPCs with electrical, self-sensing, and electromagnetic shielding characteristics will be introduced. Their use can lead to sensing and smartness in our sustainable structures leading to use of AI in structural performance and management analytics.

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## Presenter



Nemkumar (Nemy) Banthia is a University Killam Professor, Distinguished University Scholar and Senior Canada Research Chair at University of British Columbia. His academic output includes 450 refereed papers, 9 patents, 20 monographs and nearly 75 doctoral and post-doctoral students. Dr. Banthia serves on 9 editorial boards and is the Editor-in-Chief of the J. of Cement and Concrete Composites with a reported 2022 Impact-Factor of 10.5. With his citations approaching 22,000, Dr. Banthia remains one of Top 25 ‘Most Cited in Construction & Building Materials’ as per Platinum H-Index.

A civil engineer by training, Dr. Banthia’s research is in the areas of materials science, structural engineering, sensing and artificial intelligence applied to infrastructure. Dr. Banthia has chaired over 30 international conference and has given over 250 keynotes in over 25 countries. With more than 30 international awards, Dr. Banthia is a fellow of six global societies including the American Concrete Institute, Canadian Society for Civil Engineering, Indian Concrete Institute, Canadian Academy of Engineering, Indian National Academy of Engineering and the Royal Society of Canada. The last two are the highest academic honors in India and Canada.

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Dr. Banthia is the founding Scientific Director of India-Canada Research Center: IC-IMPACTS – the most successful international center hosted at UBC. IC-IMPACTS has graduated over 350 PhD students with 31 patents, over a 1000 journal papers and 8 start-ups. It has placed 24 novel technologies in Indian and Canadian communities including the 1 km self-healing road placed in Tondebhavi, Karnataka, India.