AJITANSHU V. MISHRA

Institute of Contruction
and Architecture
Slovak Academy of Sciences

Project number
1213/02/01

Project duration
9/2022 - 8/2025

BIOGRAPHY

Ajitanshu Vedrtnam has two decades of research and teaching experience. He has completed B.E. (Mechanical Engineering), M.B.A. (Marketing), M.E. (Manufacturing)-Gold Medalist, GATE (M.E), and Ph.D. (Applied Mechanics). Dr. Vedrtnam is the recipient of prestigious fellowships including Marie-Curie grants (GOT ENERGY TALENT and SASPRO2), post-doctoral fellowships from University of California, USA, National University of Ireland, Ireland, Singapore Research Foundation, Singapore, Technion Israel institute of Technology, Israel, Research Fellowship from Ministry of HRD, Govt. of India. Dr. Vedrtnam has secured < INR 92 million funding for multiple research projects by International and national funding agencies such as the Department of Science and Technology, Govt. of India, European Union, IC IMPACT, Canada, Science Foundation Ireland, Singapore research Foundation, Ministry of HRD, India, NAVA, Poland etc. Dr. Vedrtnam has published more than 110 articles including, 50+ articles in high impact journals, patents and 4 books. Dr. Vedrtnam has been actively involved in the translational research for building state-of-the-art technological systems to handle key challenges related to structural materials, energy supply and environmental issues. Dr. Vedrtnam serves as a scientific evaluator, member of experts in several panels and committees to various governmental and non-governmental agencies; member of Ph.D. committee, and has been invited for 100+ plenary, keynote and invited lectures in the international conferences. He has guided a good number of students on Cement-Based Composites, Energy storage materials, Bio-fuels, Structural glass, Additive Manufacturing, Composite Materials, and Aerodynamics. He is serving as editor-in-chief, editor, editorial board member and reviewer for many web of science indexed and other peer reviewed Journals.

PROJECT SUMMARY

Improving Structural Safety and Energy Efficiency Through Development of Extreme Temperature Resistant Sustainable Cement-Based Composites with Post-Fire Self-Healing Features

The performance deterioration of concrete in extreme temperatures (fire, freeze-thaw cycles (FTC)) is considerably investigated. Concrete is crack prone due to FTC, drying shrinkage, fatigue and creep loading, delayed ettringite formation, reinforcement corrosion, etc. The performance of concrete declines in fire due to constituents' thermal incompatibility, aggregate and cement paste interface debonding, aggregate deformation, calcium silicate hydrate (C-S-H) gel disruption, cement paste chemical transformation, and internal pressure resulted from entrapped steam. Thus, architects and engineers are cravings for energyefficient alternatives that do not compromise with their design intent or extreme temperatures requirement. This proposal aims at developing extreme temperatures resistant CBCs that have post-fire self-healing ability. The novel post-fire self-healing CBCs will be developed by selecting the most appropriate biogenic crack-healing method, customizing distribution and controlling bacteria's activation through novel encapsulation and immobilization methods. The extreme temperatures resistant CBCs development will utilize passive and active methods. Passive methods will consist inclusion of non-combustible porous combustion products in correct proportion, determination of the suitable constituents, and treatment methods. The use of water mist curtains and innovative lubrication systems will be covered in the active methods. The novel experimental methods such as dynamic fire test coupled with ultrasonic tests will provide data about the developed CBCs during the realistic fire scenario. The finite element and simplified mathematical models will be established and validated using experimental data, allowing examination of conditions that were not examined experimentally. These models will allow engineers to conduct a performance-based design of CBC during fire events. The mitigation strategy of chemical and thermal degradation in CBC will be suggested.

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PUBLICATIONS

[1] Vedrtnam A. Novel treatment methods for improving fatigue behavior of laminated glass. Composite Part B. 2019, 167:180-198
https://doi.org/10.1016/j.compositesb.2018.12.037

[2] Vedrtnam A. Novel method for improving fatigue behavior of carbon fiber reinforced epoxy composite. Composite Part B. 2019, 157: 305-321
https://doi.org/10.1016/j.compositesb.2018.08.062

[3] Vedrtnam A, Gunwant D. Modelling improved fatigue behavior of sugarcane fiber reinforced epoxy composite using novel treatment method. Composite Part B 175 (2019) 107089
https://doi.org/10.1016/j.compositesb.2019.107089

[4] Vedrtnam A, Bharti S, Chaturvedi S. Experimental study on mechanical behavior, biodegradability, and resistance to natural weathering and ultraviolet radiation of wood-plastic composites. Volume 176, November 1 2019, 107282 Composite Part B (2019)
https://doi.org/10.1016/j.compositesb.2019.107282

[5] Vedrtnam A, Sharma SP. Study on the performance of different nano-species used for surface modification of carbon fiber for interface strengthening. Composite Part A, 125 (2019)
DOI:105509 10.1016/j.compositesa.2019.105509

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