Abstract

This presentation confronts the urgent need to decarbonize construction and infrastructure, a major contributor to global CO_2 emissions. Reaching 2050 Net Zero targets demands a fundamental shift, starting with a drastic reduction in embodied carbon.

We propose fast-growing bio-based materials (BBMs), such as vegetable fibers, bamboo, bio-aggregates, and bio-concretes, as a strategic pathway. These renewable, carbon-storing resources enable low-carbon, circular, and energy-efficient construction, offering excellent hygrothermal performance and strong alignment with circular economy principles like design for disassembly.

Drawing on experimental research from NUMATS/UFRJ, we showcase advances in high-performance composites, bamboo bio concrete, bio-based panels, and structural reinforcement. Findings confirm that with optimized design and treatment, bio-composites can deliver reliable mechanical performance, long-term durability, and competitive thermal behavior.

We also address key challenges in durability, fire resistance, scalability, standardization, and life-cycle assessment. The conclusion underscores that integrated solutions combining innovation, digital tools, circular practices, training, and supportive policy are essential to scale adoption and accelerate the sector's sustainable transition.