National Institute of Technology Rourkela

Departmental Seminar

Seminar Title	: Conference Return Seminar: Insights into the fracture mechanism of concrete under the influence of polypropylene fiber through acoustic emission
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Venue	: CE Seminar Hall
Date and Time	: 02 May 2025 (04:30 pm)
Abstract	: Concrete is a quasi-brittle material characterized by limited tensile strength and toughness, making it prone to cracking under different loading conditions. Its fracture behavior is heavily influenced by factors such as aggregate size and type, water-cement ratio, curing practices, and the incorporation of fibers. This research investigates the impact of polypropylene fibers on concrete's fracture performance using Acoustic Emission (AE) monitoring. The study aims to correlate AE parameters—such as event counts, amplitude, and energy—with various fracture stages, providing insights into the initiation, growth, and merging of microcracks leading to large-scale failure. The distribution of AE events is used to quantify the relative brittleness of the specimen. The nature of cracks, i.e. tensile or frictional can also be determined through the average frequency of AE. The b-value analysis of AE events can give further details on the crack growth rate in a specimen. Geometrically similar concrete specimens with varying amounts of polypropylene fibers were subjected to controlled static loading, while AE sensors continuously tracked crack development. The study captures key characteristics of the Fracture Process Zone (FPZ), such as its size, development rate, and the transition from stable to unstable crack growth. The results demonstrate that polypropylene fibers effectively enhance concrete's fracture toughness, as confirmed by AE analysis. The findings provide crucial insights into the behavior of the FPZ, which can aid in optimizing concrete designs and improving the durability and performance of concrete structures, especially in applications where crack control and damage monitoring are essential.