Study on fracture process of steel fiber reinforced cement mortar subjected unconfined uniaxial compression using acoustic emission testing

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Researchers earlier confirmed that the performance of the cement based materials can be improved by the addition of steel fiber, but the damage processes become more complex. The acoustic emission (AE) technique is useful in determining the internal damage inside the materials in real time. It is known that the cement based materials have weaker tensile strength, flexural strength, impact strength. But by using the steel fibers flexural strength, impact strength, tensile strength, ductility, toughness can be improved. This article reports on the acoustic emission (AE) characteristics of steel fiber reinforced cement mortar (SFRM) under the monotonically increased unconfined uniaxial compression load. SFRM specimens with different volume percentage of fiber (Vf) content were tested in the laboratory under unconfined uniaxial compression and simultaneously the generated AE were recorded. The damage evolution was studied using AE waveform parameters namely energy, RA value, average frequency (AF). It was observed that the cement matrix cracked at the initial stage of the fracture process and further develops as the load increases until fibers were pulled-out at the collapse stage. The cumulative AE energy is proportional to the ductility of the cementitious material. The damage status can be assessed by identifying the damage stage which obtained by the analysis of the AF value. AE parameters are proportional with the progress of damage.