



## Mechanical behaviour of self-compacting concrete made with non-conforming fly ash from coal-fired power plants

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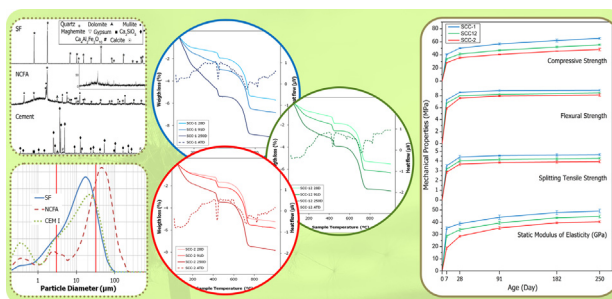
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### HIGHLIGHTS

- A comparative study of three types of SCC was carried out.
- The mixes comply with the self-compacting requirements.
- The aging mechanisms of the SCC mixes (SCC-1, SCC-12, and SCC-RF) were different.
- Pozzolanic reactions occurred during the curing of SCC-1.
- Shrinkage in the NCF mix was lower because of the larger particle size.
- Non-conforming fly ash from coal-fired power plants is adequate to produce SCC.

### GRAPHICAL ABSTRACT



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### ABSTRACT

Currently, global sustainability depends on achieving integrated productivity in all economic sectors, making it possible to respond to the environmental challenges facing humanity at present. With the dual objective of optimization of natural non-renewable resources and waste recovery, this study has carried out an evaluation of the fly ash of a coal-fired power plant that does not meet the criteria of conformity as a filler in concrete. One may conclude that it is possible to obtain a self-compacting concrete (SCC) by replacing (in volume) a natural siliceous filler (SF) with non-conforming fly ash (NCF) from coal-fired power plants to obtain a superior mechanical behaviour than the minimum levels stipulated by the Spanish Code on Structural Concrete and/or Eurocode 2. The SCC manufactured with NCF partially presented good performance in terms of self-compactability, mechanical behaviour, and shrinkage. To achieve these results, a comparative study of three mixes of SCC was carried out. In the first (SCC-1), a commercial SF (SCC reference) was used; in the second a mix, 1:1 in volume, SF and NCF (SCC-12) was used; and in the third, only NCF was used (SCC-2). The mechanisms for setting the mixes have been identified. Pozzolanic and mild carbonation reactions were present in the SCC-1 mix. In SCC-12, both pozzolanic and carbonation reactions were observed. In the SCC-2 mix, only carbonation processes were observed. The mechanical behaviour of the SCC-1 and SCC-12 mixes is better than that of SCC-2. The

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