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COMPRESSIVE STRENGTH OF FIBRE REINFORCED CONCRETES

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❑ OBJECTIVE

- Study of concrete behavior at high temperatures, and characterization of the spalling phenomenon, through the development of concretes with enhanced fire behavior.

❑ PORTUGUESE EXPERIMENTS

- Three concrete compositions: one without fibers (HSC), one with steel and polypropylene (PP) fibers (HSCSPF) and a third one with steel and glass fibers (HSCGF) (Table 1);

Table 1 - Concrete compositions (per *m3)*

	CEM [kg/m³]	*CS1 [kg/m3]*	*CS2 [kg/m3]*	*CA [kg/m3]*	*FS [kg/m3]*	*LF [kg/m3]*	*W/C*	*SP [%CEM]*	*PF [kg/m3]*	*SF [kg/m3]*	*GF [kg/m3]*
HSC	400	600	321	230	470	200	0.3	2.9	-	-	-
HSCSPF	400	600	321	230	470	200	0.3	11.6	1	70	-
HSCGF	400	600	321	230	470	200	0.3	11.6	-	-	1.5

Figure 1 - Test system.

- Compressive strength tests (Fig. 1), at high temperatures, in cylindrical specimens of Ø=75mm and h=225mm (h/Ø=3 according to the RILEM TC-200HTC recommendations) were carried out.
- The specimens were subjected to a constant load ($0.7f_{cd}$) during the heating and stabilization period of the temperature.
- The specimens were heated at a heating rate of 3ºC/min, until the desired level of temperature (300°C, 500°C and 600°C). (Fig. 2).

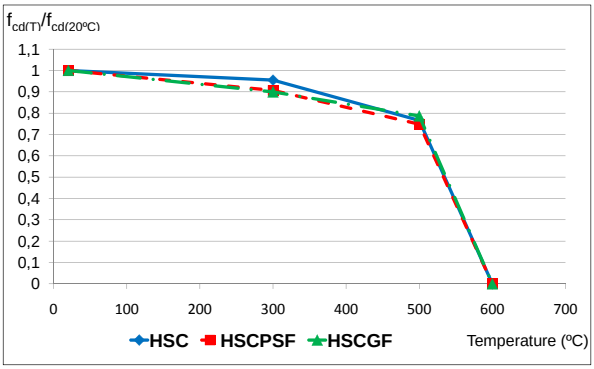

Figure 2 - Concrete compressive strength *vs maximum temperature.*

❑ BRAZILIAN EXPERIMENTS

- Concrete mixtures reinforced with 0.25% and 0.5% by volume of PP fibers (C65PP0.25/C85PP0.25 and C65PP0.5/C85PP0.5 series, respectively) (Table 2);
- Assessment of residual compressive strength and elastic modulus after heating specimens (400, 650, 900ºC) at a rate of 10ºC/min and cooling to room temperature (Fig. 3);
- Spalling and total porosity studies were also carried out.

Table 2 - Mix proportions for the polypropylene fiber reinforced concrete - HSC (per m3)

	CEM [kg]	*SILICA [kg]*	*SAND [kg]*	*AGG. [kg]*	*W [l]*	*SP [l]*	*FIBRES [kg]*
C65	365	37	780	857	156	8.30	-
C85	414	42	694	895	151	8.49	-
C65PP0.25	365	37	780	857	156	8.30	2.28
C65PP0.5	365	37	780	857	156	8.30	4.56
C85PP0.25	414	42	694	895	151	8.49	2.28
C85PP0.5	414	42	694	895	151	8.49	4.56

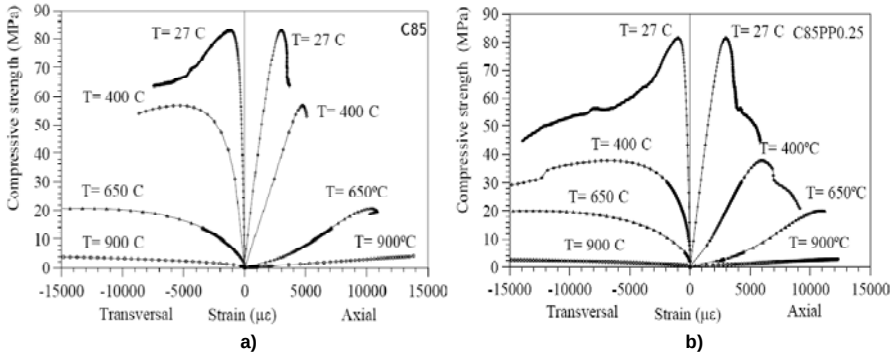

Figure 3 - Compressive stress-strain curves:
(a) Concrete series C85; (b) Composite series C85PP0.25

❑ CONCLUSIONS

- The inclusion of PP fibers in the concrete compositions avoided spalling. The specimens of concrete with steel and PP fibers had better performance than those with glass fibers;
- In compression tests, the glass fibers have an identical behavior to the PP and steel fibers;
- At high temperatures, the concrete specimens reinforced with PP fibers showed a strength and stiffness reduction more pronounced than those observed to the plain HPC mixtures.

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