**REVIEW PAPER** 



## The Effect of Polypropylene and Steel Fibers on the Properties of Concrete at Normal and Elevated Temperatures—A Review

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## Abstract

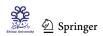
Fibers are especially used to boost different characteristics of concrete and to make concrete efficient, wherever it lacks performance. This study was carried after addition of synthetic fibers namely Polypropylene fibers and Steel fibers and their respective effects on some important characteristics of concrete like mechanical properties, crack analysis, permeability, and spalling at ambient and raised temperatures. It was found that polypropylene enhances the mechanical properties and impact resistance of concrete. An optimum quantity of fiber enhances these properties, but if fiber dosage exceeds the optimum dosage, there is a certain decrement in properties. Although the optimum percentage obtained was different for different properties, but in general, all properties got enhanced if the addition of polypropylene was less than 2%. Polypropylene also increased the spalling resistance of concrete up to 600 °C, but beyond 600 °C, it reduces the effect of spalling and could not prevent it entirely. The inclusion of steel fibers to concrete showed a significant positive influence on the mechanical properties at high temperatures and increased the temperature at which spalling occurs up to a dosage of 1-1.5%, beyond 1.5%, compressive strength decreases. Between 20 and 700 °C, steel fiber reinforced concrete showed 40% more split tensile strength than normal concrete.

Keywords Polypropylene fibers · Steel fibers · Elevated temperature · Compressive strength · Permeability · Spalling · Split tensile Strength · Modulus of Elasticity

Abbreviations		HSC	High strength concrete
Notations	Full Form	HyFRC	Hybrid fiber reinforced concrete
CS	Compressive strength	M1	Concrete mix with 0% fiber
E/E'	Relative elastic modulus	M2	Concrete mix with 1% fiber
FA	Fly ash	M3	Concrete mix with 1.5% fiber
fc/f'c	Relative compressive strength	M4	Concrete mix with 2% fiber
FRC	Fiber reinforced concrete	MK	Metakaolin
ft/f't	Relative tensile strength	MOE	Modulus of elasticity
f <sub>u</sub>	Ultimate compressive stress	NC	Normal concrete
GGBS	Ground granulated blast furnace slag	NSC	Normal strength concrete
H–C	Heating-cooling	PP12	Polypropylene fiber of 12 mm length
HPC	High-performance concrete	PPF	Polypropylene fibers
HPP	High performance synthetic macro	PPFRC	Polypropylene fiber reinforced concrete
	polypropylene	PVA	Polyvinyl alcohol (fibers).
HPPF	High performance synthetic macro poly-	RC	Reinforced concrete
	propylene fibers	RC80/60 BN	Dramix <sup>®</sup> bright and low carbon steel
			fiber reinforced concrete of fiber length
Muhammad Dilawar Bhat			60 mm and slenderness ratio of 80 [ ø of
dilawar.bhat@islamicuniversity.edu.in			fiber = $0.75 \text{ mm}$ )

RCS

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Residual compressive strength