A Supplementary Information for

Synergistic ultrafine steel slag and fly ash for steel passivation in sustainable ternary cements: Temperature-dependent stability and composition regulation

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Table S1. Comparison of this work with representative literature on steel passivation in simulated pore solutions and blended-binder systems.

Study	Binder / environment	Key characterization	Performance/film indicators reported	Main finding / implication	What this work adds
Poursaee[1]	Mortar vs synthetic pore solution	Electrochemical monitoring	Time to passivation; passivation kinetics	Demonstrates the need for sufficient passivation time; SPS differs from mortar	Uses 2 h-14 d evolution to quantify film growth and link to chemistry
Ghods[2]	Simulated pore solution with varied composition	EIS; polarization	Film protectiveness depends on pore solution composition	Confirms solution chemistry governs passive film properties	Extends to ternary US-FA-OPC and resolves which ions shift with USS dosage
Williamson & Isgor [3]	Simulated concrete pore solutions (pH/ions/Cl⁻)	M-S; electronic properties	Donor density; two donor levels; chemistry-sensitive electronic behavior	Links pore solution chemistry to passive film electronic properties	Uses N_{D1}/N_{D2}, C-V and EIS to identify an optimal USS dosage (20-30%)
Long[4]	SCPS with compositional	Electronic and surface chemistry	Electronic properties + surface chemistry	Demonstrates composition-	Adds ternary binder-driven ionic

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	effects	analysis		dependent electronic/surface chemistry	redistribution and temperature effect on the optimal mix
Achenbach[5]	Low-carbon binders in mortar	Passivation in alternative binders	Passivation behavior across binder families	Shows binder type controls passivation	Provides a mechanistic "chemistry-film electronics" framework within US-FA-OPC
Yang [6]	Composite cement with USS (SPS)	Electrochemical and characterization	Passivation trends in USS-containing extracts	Beneficial USS range nearly 10-30 wt% (optimum around 30 wt%)	Adds a systematic USS/FA replacement series and identifies an optimal USS replacement range (20-30%) for stable passivation.

Note: Direct numerical comparison across studies is not always meaningful due to differences in solution composition, exposure time, and temperature; therefore, the table focuses on reported indicators and qualitative performance trends.

References

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