

A New Alkali-Silica Reaction (ASR) Mitigation Technology – Part I: Comparing with Li, Ca, Al Salts, and Densified Silica Fume

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1 Introduction

Since Stanton (1940) demonstrated that reaction between high-alkali cements and certain aggregates could cause disintegration of concrete, ASR has remained a subject of much research and discussion because of the necessity of employing marginal aggregates in many areas, as well as the limited availability of low alkali cement, class F fly ash, slag, and lithium. Tesla and other electric-vehicle makers dominate lithium consumption. Densified silica fume has been used to increase ASR resistance. Due to low volume demand, concrete manufacturers do not normally install a silo for densified silica fume. The two main issues of densified silica fume are: (1) it might cause ASR due to agglomeration, and (2) densified silica fume in bags are difficult use in concrete manufacturing. Clearly, the concrete industry is looking for alternative chemical admixtures, which are easily dispensed into a central mixer or concrete truck in ready mix concrete or precast plants, for mitigating ASR.

A direct comparison of the ASR mitigating effects of densified silica fume and the three slurries, at 14-day expansion, as a function of additive percentage by weight of cement replacement, are compiled in Figure 1.

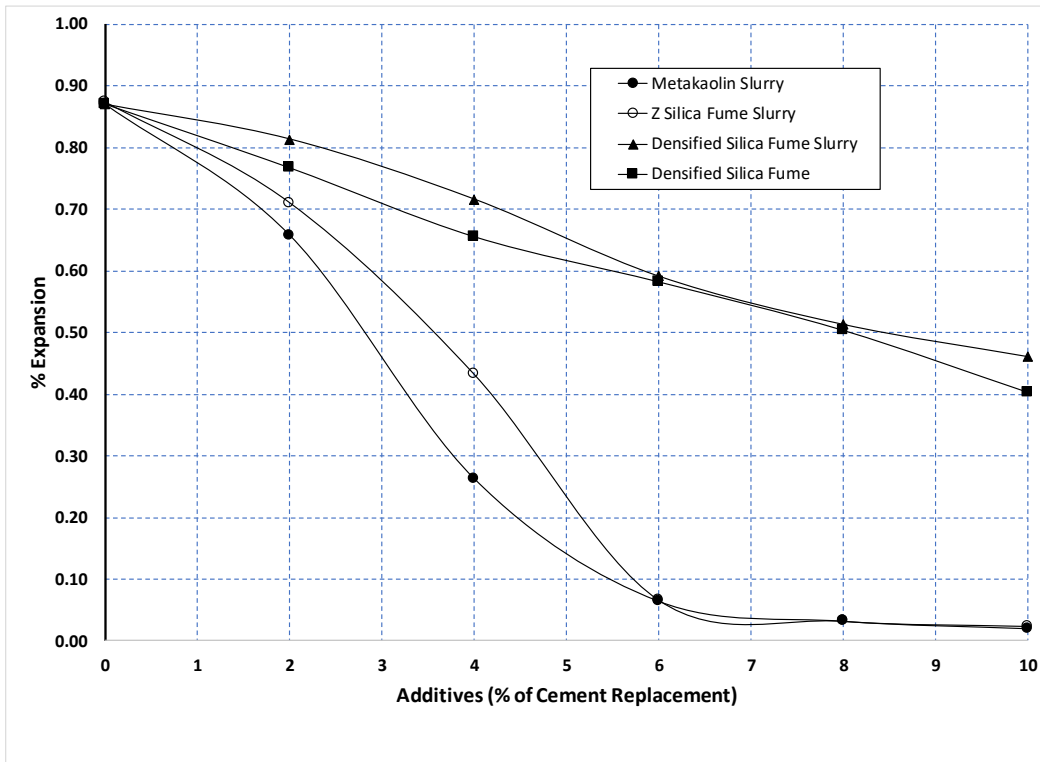


Figure 1. The comparison of ASR mitigating effects of different slurries and densified silica fume.

2 Conclusions

Based on the results of ASTM C 1567 expansions of mortar bars, the following conclusions can be made:

- For salt solutions, LiNO_3 is the best choice for ASR mitigating.
- The densified silica fume slurry has only slightly better ASR mitigating effect than densified silica fume. The slurry manufacturing procedure was unable to break-down clustered silica fume particles.
- Both pumpable slurries of metakaolin and Z silica fume have an excellent ASR mitigating effect.

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References

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