Alkali-silica gel’s porosity, high surface area, and

Alkali-silica reaction (ASR) is a chemicalreaction between alkaline cement pore solution and siliceous aggregates, causingphysical damage to concrete due to the internal formation of an expansive gel.

Thisdeleterious reaction is best described in three processes: dissolution ofsilica, gel precipitation, and swelling of the gel. Dissolution of silica occurswhen hydroxyl ions from the cement pore solution increase the pH of theconcrete and dissolves the aggregate’s silica bonds. Calcium ions also recyclealkalis from the precipitating silica gel, further increasing dissolution andpH levels. In the absence of calcium, the dissolved species innocuously remainin solution. However, an abundance of metal ions found in cement pore solutionreact with dissolved silica to form new poly-metal silicates, which condenseand precipitate ASR gel. The gel’s porosity, high surface area, and mobility causesswelling in the presence of water, which ultimately leads to expansive internalpressure and cracking of the concrete.