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**Abstract**

The present study was conducted to provide a better understanding of the alkali-silica reactivity (ASR) of siliceous limestones in concrete applications. A Swiss siliceous limestone, which is potentially reactive, was subjected to a series of tests. Microbar tests were first conducted to classify the limestones reactivity with respect to ASR. Two other methods were then used to characterize the amount of SiO<sub>2</sub> present. First, an analysis of the chemical composition with petrographic and mineralogical characterizations was carried out, and second, a model reactor was used to characterize the silica reactivity. The results showed a siliceous reactive limestone. In petrography, three main types of carbonate lithology were outlined according to their SiO<sub>2</sub> and glauconitic content. The emphasis was placed on the types of SiO<sub>2</sub> and their sizes: a finely dispersed micro- to crypto-quartz has been highlighted by SEM and TEM, and analysed as quartz. The reactive free SiO<sub>2</sub> content, obtained by a mineralogical calculating method, completes the petrographic results. The proportion of reactive free SiO<sub>2</sub> could be essentially attributed to the presence of finely dispersed micro- to crypto-quartz from TEM observations which is probably very reactive towards the ASR due to its small-size. The presence of finely dispersed micro- to crypto-quartz is important to consider, due to its potential effects on the concrete mixture. The grain size of SiO<sub>2</sub> seems to be a supplementary key parameter, in addition to crystallinity and strain, since it can promote ASR development with some siliceous aggregates.

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