The alkali-aggregate reaction (AAR) was first identified as a cause of concrete degradation for the first time in the decade of 1940 in California, U.S.A. [1]. Since then, it has been identified in more than 40 countries all over the world [2].

Since geographical location, environmental concerns and transport costs often limit the availability of sound aggregate, AAR inhibiting measures are sometimes needed. These measures have typically been the use of supplementing cementing materials (fly ash, blast furnace slag or silica fume), while the use of lithium salts has also been studied.

Polymer additions are typically used for improving the properties of mortars for the repair of concrete structures, such as tensile and flexural strengths, adhesion, waterproofing and chemical resistance.

Besides characterization of the PCMs formulated with the existing polymer additives in the Portuguese market [3], an ongoing research project in LNEC was also set to study the polymer action on AAR in cement mortar. The polymer addition may interfere with AAR development by limiting the ingress of moisture and the availability and solubility of calcium hydroxide (CH) in the cement mortar.

As sufficient moisture content is needed, with AAR starting to clearly develop at a relative humidity of 85-90% [2], the polymer may act as a barrier against the ingress of moisture and thus inhibit the development of AAR.

CH has long been associated with the expansion resulting from AAR [4] and more recent studies [5] confirm that the expansion resulting from AAR is higher for mortars with higher CH content. As shown by the work of Ribeiro [3] and several other authors, of which [6] is an example, the addition of polymer decreases the quantity of CH formed during cement hydration, while also modifying its morphology. The presence of an interpenetrating polymer film in the comatrix of PCMs may also limit the ion mobility and thus the solubility of CH.
Saccani and Motori [9] have already studied the effect of an epoxy polymer addition on AAR in cement mortars. These authors concluded that the epoxy polymer reduced the expansion of mortars made with reactive aggregate to the same order of magnitude of the expansion verified in a cement mortar formulated with sound aggregate.

The ongoing research program developed in LNEC includes the characterization of the relevant properties related with AAR in PCMs formulated with styrene-butadiene, acrylic and epoxy polymer dispersions. An accelerated alkali-silica reactivity test method will be performed and the properties related with moisture transport, porosity, deformability and mechanical strength will be determined. The quantity and solubility of CH formed in the PCMs will also be determined.

REFERENCES