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The alkali-aggregate reaction (AAR) in concrete is a harmful internal expansive process with consequences that may require the demolition and replacement of structural elements or even whole structures. Although Stanton identified this reaction in 1948, given the fairly slow reaction rate and its dependence on the environmental conditions to which a structure is exposed, it was not deemed a major pathology in concrete until some years later. With a view to minimising its impact, possible aggravating and extenuating circumstances have been and are being studied in the laboratory and in situ in new or existing AAR-affected works. That is a complex endeavour also for other types of internal expansion such as deferred ettringite formation (DEF) whose development is affected by similar factors may occur in conjunction with or in the absence of AAR.

The issue has acquired crucial importance at this time, for much of the built heritage is now of sufficient age to have developed the pathology. The growing number of incidents of the alkali-silica reaction (ASR) presently reported in distinctive structures such as dams, nuclear power plants, bridges, viaducts and tunnels could compromise the safety of people and the built heritage.

Prevention and abatement of the effects of the alkali-aggregate reaction call for coordinated action by designers, builders, structural engineers, computer model developers and materials experts. Progress in solving or attenuating the problem of expansion in concrete will depend on the synergies among these various professions. Such synergies are particularly necessary today, when the construction industry is being called upon to minimise waste, reduce its CO_2 footprint and enhance its sustainability with no detriment to structural functionality, safety or durability. All these challenges must be addressed when designing durable concretes, whose manufacture often entails the use of local and possibly reactive materials.

In recent years the combination of testing and mathematical modelling has yielded significant advances in the diagnosis, prevention and prognosis of the alkali-aggregate reaction. At the same time, researchers continue to work to confront new challenges posed in respect of construction components, design and procedures.

The articles in this special issue of *Materiales de Construcción* were selected from among the papers submitted to the 2020-2022 International Conference on Alkali-Aggregate Reaction (16th ICAAR) to be held at Lisbon, Portugal, on 31 May to 2 June 2022. A total of 15 editions of the ICAAR, the primary expert forum on the reaction, have been held to date.

The papers carried here deal with: comparative approach of volcanic rocks; critical review of the alkali release from aggregates; mechanical strength of ASR-alterateed recycled concrete; Raman mechanical strength of ASR-altered recycled concrete; numerical analysis of ASR products due to temperature; microscopic analysis of how and where ettringite crystallises; detection and modification of concrete properties due to DEF; long-term effectiveness of silica fume and fly ash; assessment of laboratory tests vs fieldl structural concrete and estimated service life of concrete pavements with ASR. Together these articles constitute a showcase of international collaborating, involving the participation of 20 institutions headquartered in 10 countries.

Dr. E. Menéndez
IETcc-CSIC