Computational chemo-damage modelling for assessment of concrete patch repair durability

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Abstract: A large proportion of concrete deterioration, results from cracking damage as a consequence of ingress of aggressive environmental species. For patch repair systems, only a crack-free repair system will ensure a repair capable of extenuating these attacks and guarantee strength and functionality. Patch repair systems are however potentially prone to crack and delaminate over a short period of time and as such the contributory mechanisms of environmental attack are further aggravated and pose a genuine durability concern. Addressing this concern requires model identification of factors central to the interaction between moisture migration, shrinkage, creep, cracking and species transport detrimental to the durability of repair. In this work, a coupled approach using finite elements is used to develop a nonlinear model with diffusion providing the driving force for shrinkage strain and chemical reaction fields. Initiation and growth of damage or cracks are simulated in accordance with a unified chemo-damage constitutive relation internally compatible with the incipient strain field, whether with or without chemical actions in a seamless manner. The use of the model to simulate one-way coupled phenomenological behavior of concrete patch repair systems subjected to drying shrinkage has been reasonably well captured in terms of risk factors associated with predicting performance of the patch repair system.