

# Current density and oxygen depletion in a galvanic pair embedded in concrete

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Chloride ion presence in the pore solution causes corrosion of the rebar in reinforced concrete structures. This corrosion causes rebar expansion which in turn results in the deterioration of the structure thereby effecting its resilience. IC sized sensory systems can be distributed widely around the structure, since they are miniature and very low cost. Given the possibility of obtaining wide sensory coverage with such miniature sensors, it would be possible to detect chloride ion ingress in real time thereby allowing interventions to be carried out in a timely fashion. This would make the structure potentially much more resilient. An IC sized sensory system based on a galvanic pair of electrodes can be used to provide the backbone for such a reliable and responsive system. The galvanic pair sensory system can also be used to provide sufficient current density which would enable it to provide power to the IC itself, apart from acting as the chloride sensory element. The electrochemical reaction occurring in the galvanic pair, consumes oxygen, which would need to be effectively replenished for the reaction to be able to sustain itself. It is therefore imperative to model and study oxygen depletion and replenishing mechanisms in conjunction with current densities which can be sustained by a galvanic pair embedded in concrete. Such studies would then act as the groundwork needed to be able to design and build an effective sensory system. This paper outlines the modelling and analysis carried out to study oxygen depletion with corresponding current densities obtained. This background would enable the establishment of the parameters required for the later design an effective sensor and power supply.