Concentration effects on the spatial interaction of corrosion pits occurring on zinc in aqueous sodium chloride.

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The scanning vibrating electrode technique (SVET) is used to study the morphology of corrosive attack on unpolarized, pure zinc in varying concentrations of near neutral aqueous sodium chloride. In all cases attack is localized. As NaCl concentration is reduced from 5 % (w/v) to 0.0005 % (w/v) the morphology of attack changes from large, irregular areas of anodic activity to a regular array of evenly spaced anodic pits set in a fixed cathodic current. The total corrosion current, obtained from a numerical area integral of the SVET data is shown to increase with the square root of electrolyte conductivity. The number density of pits (pits per unit area) is shown to decrease with increased NaCl concentration. A simple, theoretical model is developed which explains the density and distribution of corrosion pits on the basis of solution conductivity and the ohmic potential drops in solution which result from the pitting current. This spatio-temporal model considers the probability of a stable pit evolving from random transient pitting events on the basis of the overpotential available to drive the individual pit current and equal the pit stability product.