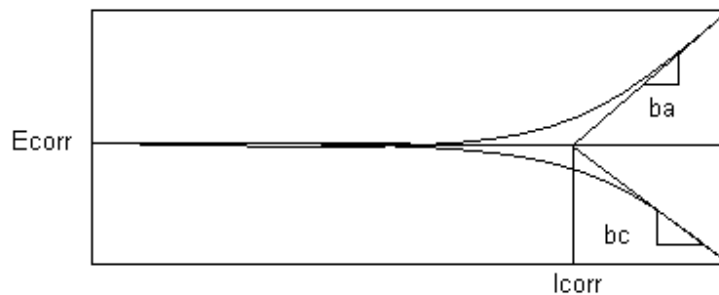
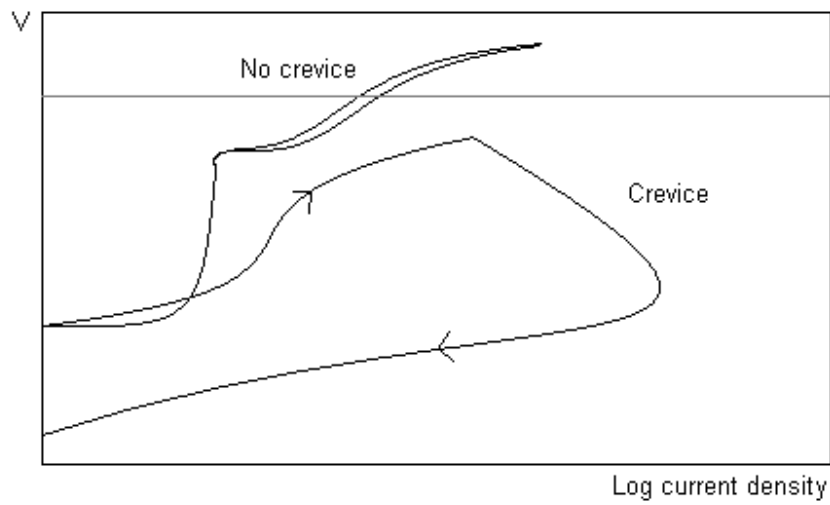

Cyclic Voltammetry

Cyclic sweeps are used to measure corrosion that proceeds at about the same rate all over the metals surface (uniform) and corrosion at discrete sites on the surface e.g. pitting crevice and stress corrosion cracking (localised). A typical experiment comprises of an electrochemical cell containing the electrolyte a reference electrode a platinum auxiliary and a working electrode of the metal under test. The instrument is connected RE to reference electrode AE to the platinum and WE1 to the working electrode. This applies to the Gill AC the Gill 8 and 12 the Field Machine and the manual potentiostat. A sweep is programmed into the sequencer say -1000 mV to +1000 mV @ 20 mV/min and the test started. The results can be interpreted in the Analysis package. To measure uniform corrosion the method of Tafel extrapolation is used the Tafel slope being the slope of the straight line portion of the semi-logarithmic polarisation curve. To determine the degree of localised corrosion the amount of hysteresis between the positive going sweep and the negative going sweep is calculated.



The diagram above shows a plot of voltage versus $\log(\text{current})$. At large perturbations away from E_{corr} the reaction measured becomes almost totally oxidised (when going positive) or almost totally reduced (when going negative). The equations that describe the reactions at large overpotentials can be simplified to a linear relationship i.e. Anodic overpotential = $ba \cdot \log(i_{\text{app}}/i_{\text{corr}})$ Cathodic overpotential = $(-bc \cdot \log(i_{\text{app}}/i_{\text{corr}}))$. This allows an extrapolation of i_{app} from either the anodic or cathodic Tafel region to the open circuit potential and hence to obtain the corrosion current.



This is an example of a cyclic polarisation on high chrome steel in 1M NaCl. Two samples are scanned and the results show that one has no crevice while the other has a crevice. The large hysteresis is typical of localised corrosion.