the electrochemical behaviour of copper in aqueous media

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1. A literature survey of the different theories ofoorrosion and passivity of copper in differentmedia (aoidio, alkaline and ~eutral) i8 givenwith particular emphasis on the effect of aggressiveions as well as the use of organic inhibitors.2. The potential of the oopper electrode was followedin oxygenated solutions of the sodium salts ofcarbonate, bicarbonate, Inonohydrogf!nphosphate,chromate, borate, tungestate,_ -chloride, bromide widsulphate, respectively, of varying concentrations.). The steady state potential, Bst.' varies withconcentration of the anions (mentioned in 2) aocordingto4. When the BtSgressive iona cr" and nr- were added tothe carbonate, chromate and borate u~)lutiolls, inwhich copper electrode was previously eqUe~ibrated,sigmoidal s-a~d curves were obtained. The~intsof inflexion of these curveD occur at larger additionof the aggressive ions, the higher-ot-'the concentration of the inhibitive anf.one in solution. The twoparameters are related as:Log Cinh•• KJ + nJ log Cagg.For the exponent "n)" it Waf' found thatsi- Its value depends primarily on the type of theinhibitor and is higher in borate solutionsthan in oarbonate and chromate.ii- Its value for 01- is greater than that for Brinthe borate solutions.5. The dissolution of oopper in rulO) was determined bymeasuring the temperature rise usinG J.lyliuSthermometrictechnique. The rate of dissolution was foundto inorease on inoreasing the aoid conoentrationaccording to an autocatalytic mechanism involvinG •the formation of lliIc:O".6. Addition of monomethyl-. dimethyl-. trimethyl-. monoethyl-.diethyl-. triethyl-amines and hydra.zinedecreases the dissolution rate of Ou in 6 11 IrNO) byadsorption on the metal surface and/or by alteringthe autocatalytic dissolution reactions. On theother hand, 01-, IIO; and:l)'4 iOilS alter the rateof dissolution through the interference wLth oathodioareas. These ions are assumed to compete with someoathodio depolarizing compommts for adsorption si teaon the metal surfaoe._ 109 -7. Cyolio yolt8""""g%'8o1u1rves were construoteli inNa2COJsolutions as a tunotion of the final enodiopotential. eleotrolyte ooncentration end soanningrate.8. The effeot of addition of increasing conoentrationsof Cl ions on the cyclio voltBllIJl1etryof au was ----- studied in Na200J solutions of different oonoentrations.It was found that the integrated chargesunder the cyclic voltommogramsincreases mark@dlywith increasing the 01- ion concentrations, due tothe propagation of pitting corrosion. The differenoeof the oharges amounts.b.qat in the presence ~=--and absenoe of 01- ions is taken as a measure of theextent of pitting corrosion to take place-.,6. Cia-- varies with the 01- ion conoentration according tOI9. from the potentiodynamic polarization

measurements.it waS found that. the critical potential for pittingto take place varies with the 01- ion ooncentrationaocording to a sigmoidal 5-shaped ourves10. Addition of inorganic inhibitive anions. e.g •• Cr0’4’W0’4’ KP0’4 and B40’7 shift the critical pittingpotential into the noble direction indicatinginoreased resistance to pitting corrosion.11. SUfficient conoentrations of the inhibitive anionsoause complete pitting inhibition. The conoentrationof the inhibitive inorganio anions that canwithstand the corroding action of a oertainconcentration of Cl- ion can be deduoed fromequationaLog einh • ••where K4and n4 are oonstants.