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A Study on the Corrosion Behavior and Oxide Characteristics of OFHC Copper in Borate Buffered Solution.

Borate 완충 용액에서 무산소동의 부식 거동과 산화막 특성에 관한 연구

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I. Introduction

The anodic oxidation behavior and corrosion of copper have attracted the attention of several investigators because of their widespread use in different industries. A study on the corrosion and passivation behavior of copper has been conducted using electrochemical methods including potentiodynamic polarization and AC impedance spectroscopy.

II. Experimental Procedure

The working electrode was OFHC (Oxygen-free High Conductivity) Copper (99.99%). Borate buffered (0.025M $Na_2B_4O_7$-0.1 M H_3BO_3) solutions with pH 7 and 9 were used as the supporting electrolyte. Polarization curves and impedance spectrum were measured at 20℃ and 60℃ using a single compartment glass cell. A Solatron 1286 potentiostat interfaced with a PC was used for the polarization studies. And the impedance spectroscopy was conducted using Solatron 1260 frequency response analyzer.

III. Results and Discussions

The corrosion potentials of Cu in borate solutions exist in the region where the Cu_2O is thermodynamically stable. Table 1 summarizes the corrosion potential values. The charge transport

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resistance of oxide layer increased with applied potentials. Impedance results obtained at low frequency range were used to calculate the oxygen vacancy diffusion coefficient(Table 2). The diffusion coefficient was influenced by neither pH nor potential, but positively by temperature.

Table 1. Corrosion potential data summary

pH	Temperature (°C)	Corrosion potential (V_{SHE})
7	20	0.213
	60	0.187
9	20	0.039
	60	-0.021

Table 2. Oxygen vacancy diffusion coefficient in Cu oxide

PH	Temperature (°C)	Applied E(V_{SCE})	D(cm^2/s)
7	20	0.4	1.3×10^{-17}
		0.6	1.3×10^{-17}
	20	0.4	2.5×10^{-17}
		0.6	4.5×10^{-17}
9	60	0.0	1.6×10^{-17}
		0.2	1.0×10^{-17}
	60	0.2	4.6×10^{-17}
		0.4	7.2×10^{-16}

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