ABSTRACT

CYCLIC VOLTAMMETRY OF COBALT, ALUMINIUM, AND ITS ALLOYS IN QUARTERNER AMMONIUM BASED ON ORGANIC SOLVENT AS SUPPORTING ELECTROLYTE

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Cyclic voltammetry is one of many methods that are applied in electroanalysis. This voltammetry method is frequently used to analyze electroactive compounds. According to voltammogram, we can obtain both qualitative and quantitative information. Qualitative information, aside from revealing the mechanism of electrochemical reaction on electrode's surface, it is also useful in practical condition determination. One of the techniques is the technique to electrodepose metal ions on working electrode's surface. However, several reactive metal ions are hard to depose in normal condition, for instance, cobalt ion, aluminum, etc. that has a very negative reduction potential. Hence, throughout the process, it is restricted by the oxidation and reduction reaction of the water as the solvent. Therefore, it is needed to develop the cyclic voltammetry method that uses organic solvent with supporting electrolyte that has a wider working potential than wanter solvent.

The purpose of this research is to know the capability of organic solvent in dissolving metal ions that contains quaternary ammonium ionic liquid as supporting electrolyte, that it can be used to study aluminum and cobalt ion voltammogram in that system. Besides, it can also used to study chronoamperometry in aluminum and cobalt metal ion deposition. Cobalt metal ion's small amount of solubility can be solved by using ammonium quaternary supporting electrolyte.
In this research, we can obtain chosen solvent, acetonitrile and DMF (dimetyl formamide) according to cyclic voltammogram relative to dry type eDAQ commercial Ag/AgCl electrode which has a wide potential range, successively around -3,0 to +2,0 V and -3,0 to +3,0 V. According to the analysis result of working potential range of all four kinds of quaternary ammonium in acetonitrile solvent, N_{1114}.TFSI (butyltrimetylammonium bistrifluorosulphonyl)amide has the widest potential range of around -1,0 to 3,5 V.

In cobalt metal cyclic voltammetry electrodeposition relative to dry type eDAQ commercial Ag/AgCl with working and supporting electrode Pt, can be used in the potential of +0,8 V based on the performance of BDD (Boron Doped Diamond) electrode that qualified the stability term in peak rate measurement and wide working potential range. Cobalt metal ion 0,001M can be deposed with chronoamperometry technique using comparing electrode dry type eDAQ commercial Ag/AgCl, working electrode BDD, and supporting Pt wire.

Ammonium ionic liquid N_{1114}.TFSI 0,1 M in organic solvent acetonitrile is used as supporting electrolyte. The electrodeposition occurs in a more negative potential of -2,80 V. The current used is 5mA for 10 minutes. According to the SEM-EDX data, we can obtain an information that tge deposit is not homogeny yet and still hollowed, containing 0,1% of cobalt.

Aluminum metal ion 0,001 M can be deposed by chronoamperometry technique. This technique uses comparing electrode dry type eDAQ commercial Ag/AgCl, working electrode glassy carbon, and supporting Pt wire in supporting electrolyte N_{1114}.TFSI 0,1 M in organic solvent acetonitrile in a more negative potential than -1,6 V. The current used ia 5 mA for 10 minutes. According to the SEM-EDX data, we can obtain an information that the deposit is not equally distributed, amorph, hollowed, with 0,54% of Al as element, and 1,03% as its oxyde.

Electrodeposition study to produce Al-Co metal alloy using chronoamperometry method in a solution containing 10^{-3} M Al^{3+} and 10^{-2} M Co^{2+} in acetonitrile. N_{1114}.TFSI 0,1 M ionic liquid is used as supporting electrolyte. The electrodeposition process occurs chronoamperometrically in working electrode glassy carbon, comparing electrode dry type eDAQ commercial Ag/AgCl, in a potential that is more negative than -1,5 V. The current used is 5mA for 10 minutes. The deposit's characters are studied from the datas of SEM-EDX. The deposits produced are not equally distributed, amorph, and hollowed. The chemical composition of the deposit are 0,32% of Al, 0,61% of Al_2O_3, 28,10% Co and 35,73% CoO. The rest are the carbons from the electrode.

Key words**:** cyclic voltammetry, ionic liquid, quaternary ammonium cobalt, aluminium, chronoamperometry