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Evaluation of Nano-size Defect in Chromium Layers by Small Angle Neutron Diffractometry

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1. Introduction

Neutron scattering is one of powerful techniques to evaluate materials because it can determine the position and motions of atoms in condensed matter.[1] Since defects can be introduced by hydrogen evolution and metallic reduction processes during electroplating, it is important to evaluate defects in the thin chrome layers in engineering and science points of views. Although there are many reports to evaluate defects size by observation of cross sectional microstructure, the sample preparation may introduce defects in the thin layers.[2] Hence, the objective of this study, small angle neutron scattering was applied to determine the nano-size defects in thin chrome layers to find the defect size and number distribution without breaking the thin layers.

2. Experimental Method

Hexavaelnt and trivalent chrome were electrodeposited on AISI 1024 steel plate with 15 mm in width. The electro-platings were carried out in Sergent bath and chrome chloride bath with various voltage and current density range, respectively. The chrome layers were evaluated by small angle neutron diffractometry in HANARO center of KAERI. The SANS results were analyzed by ILL data treatment code.

3. Summary

Small angle neutron diffractometry (SANS) was applied to evaluate nano-size defects in chrome layers which were prepared various plating conditions. The number of nano-size defects less than about 40 nm size increase in chrome layers with plating voltage at constant current density. Average defect size number of trivalent chrome layers are larger than those of hexavalent chrome layers prepared in the conditions of similar voltage and current ranges.

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5. References

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