研究論文

$AlCl_3$-EMIC-トルエン浴から電析したアルミニウム被膜の表面光沢性に関するピリジン誘導体添加剤の効果：添加剤の分子構造と表面光沢性の関係

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The Effects of Pyridine Derivatives as Additives on Surface Brightness of Aluminum Films Electrodeposited from an $AlCl_3$-EMIC-Toluene Bath : Correlation between Molecular Structure of Additives and Surface Brightness

by

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(Received Aug. 28, 2024; Accepted Sep. 24, 2024)

Abstract

The effects of additives on the surface brightness of Al films electrodeposited on Cu substrates from $AlCl_3$-ethyl-3-methylimidazolium chloride (EMIC)-toluene ionic liquid bath were investigated for pyridine derivatives as additives in which various functional groups were introduced. The surface brightness of the electrodeposited Al films was measured as the reflectance at 450 nm. For a given series of structural isomers, the steric hindrance effects of the functional groups introduced into pyridine rings on the surface brightness was observed, *i.e.*, meta- and ortho-isomers gave smaller reflectance than para- isomers. It was found that the surface brightness of the deposited Al films can be, though roughly, related to the electron density of N atom of pyridine ring which was evaluated by *ab initio* molecular orbital calculations, *i.e.*, the lower the electron density of the N atom, the higher the surface brightness. The results obtained suggested that the active center of the additives for adsorption to the electrode surface might be the N atom of the pyridine ring and that the additive with a lower electron density of N atom in pyridine ring adsorbs more strong on the electrode surface, which moderately hinders a growth of Al nuclei, resulting in very fine particles with sizes in the nanometer range and as a result the Al film with a higher surface brightness is obtained.

1. 緒言

アルミニウム（Al）コーティングは，Al 自体の優れた耐腐食性と高い可視光反射率，そして天然資源として豊富であることから，Al コーティングによる表面装飾や光学用途の分野で大きな注目を集めている．Al の電析は，スパッタ堆積や熱スプレーなどの他の調製方法と比較して，作製上の利点（高温が不要で基板が損傷しない）がある [1]．しかし，従来の Al の電析では，電析被膜表面に高い光沢性を与えることができなかった．したがって，析出した Al 被膜に新しい光学特性を持たせるには，高い光沢性の Al 被膜を製造するための電析手順を開発する必要がある．これまでの研究では，塩化アルミニウム（$AlCl_3$）-エチル-3-メチル

令和 6 年 8 月 28 日受付

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