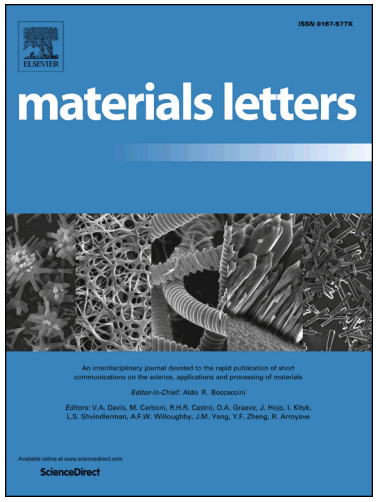

Effects of oxidation processes and microstructures on the hydrophilicity of copper surface

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Effects of oxidation processes and microstructures on the hydrophilicity of copper surface

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Abstract: A rapid, economical method to achieve superhydrophilic copper surfaces is proposed in the present study. Different microstructures could be obtained by different oxidation processes, namely, hydrogen peroxide (H_2O_2) oxidation, thermal oxidation, and their combination, and the effects of the various processes and microstructures on the hydrophilicity were investigated. The results revealed that an optimal oxidation time and solution concentration enable copper surfaces have superhydrophilicity. The superhydrophilicity, with contact angle close to 0°, was attained on a copper plate surface first by thermal oxidation and then by H_2O_2 oxidation. However, for a porous wick surface, only H_2O_2 oxidation is required to achieve excellent superhydrophilicity.

Keywords: Superhydrophilicity; Oxidation; Surfaces; Wettability; H_2O_2

1. Introduction

Recently, the wettability of material surfaces has attracted considerable attention due to its importance in both basic research and practical applications. Superhydrophilicity is an extreme wetting property wherein a water droplet can completely spread over the surfaces with a contact angle (CA) equal or close to 0° [1]. Some scholars considered surfaces superhydrophilic when they have a CA <10° [2]. Due to their unique wetting characteristics, superhydrophilic surfaces have potential in the fields of anti-fogging coatings [3], oil-water separation [4], heat transfer [5], and other applications.

Surface chemical composition and roughness are the two main factors affecting surface wettability. Some authors suggested that superhydrophilicity is mainly caused by surface hydroxyl, carboxyl, and other polar