

カーボンナノチューブ複合電解ニッケルめっき皮膜の特性評価

酒井 豊明*, 中沢 昌夫*, 深瀬 克哉*, 若林 信一**, 金子 紀男***

The Characteristic Evaluations of Nickel/Multi-Wall Carbon Nano Tubes Composite Electroplating

Toyoaki SAKAI*, Masao NAKAZAWA*, Katsuya FUKASE*, Shinichi WAKABAYASHI** and Norio KANEKO***

* 新光電気工業株式会社開発統括部材料研究部 (〒381-0014 長野県長野市北尾張部36)

** 新光電気工業株式会社コンポーネント事業部 (〒383-8581 長野県中野市草間1216-9)

*** 信州大学工学部物質工学科 (〒380-8553 長野県長野市若里4-17-1)

* Material & Process Research Dept., Research & Development Div., Shinko Electric Industries Co., Ltd. (36 Kita-Owaribe, Nagano-shi, Nagano 381-0014)

** Component Div., Shinko Electric Industries Co., Ltd. (1216-9 Kusama, Nakano-shi Nagano 383-8581)

*** Department of Chemistry and Material Engineering, Faculty of Engineering, Shinshu University (4-17-1 Wakasato, Nagano-shi, Nagano 380-8553)

概要 マルチウォールカーボンナノチューブ (以下MWCNT) の優れた特性を活用する方法の1つとして、Niめっき皮膜中にMWCNTを均一に複合させた機能めっきの開発を行った。そして、作製したNi/MWCNT複合めっき皮膜中のMWCNTの機械的特性および熱特性に与える影響について調査した。得られたNi/MWCNT複合めっき皮膜では、MWCNTを含まないNi単独のめっき皮膜に比べて、摩擦係数が0.4から0.1に減少し、比摩耗量が $4.683 \times 10^{-7} \text{mm}^2/\text{kgf}$ から $1.532 \times 10^{-7} \text{mm}^2/\text{kgf}$ に減少した。また、熱の放射率は、3~30 μm の波長範囲で、最大0.89を示すとともに、ほぼ一定の高い値を維持し、ヒートシンクとして熱抵抗を減少させる効果を有していることがわかった。

Abstract

In this study, Ni/MWCNT composite electroplating was developed with a dispersed MWCNT Ni plating bath. The MWCNT was dispersed uniformly in the bath by a dispersion material and the Ni/MWCNT composite was electrodeposited from the dispersed MWCNT nickel plating bath. The Ni/MWCNT composite electroplating obtained at the optimum conditions showed flat and smooth surfaces. The Ni/MWCNT composite electroplating obtained in this study showed excellent mechanical and thermal characteristics. This Ni/MWCNT composite plating also demonstrated outstanding wear characteristic as sliding contacts. Especially it had an outstanding thermal characteristic of emissivity, in the broad wavelength range and dissipated the heat generated in the thermal chamber effectively. Maximum emissivity reached 0.89 (wavelength : 3~30 μm). Additionally, it maintained a high fixed value for that wavelength. It had the effect of decreasing heat resistance as a heatsink.

Key Words: Carbon Nano Tube, Dispersion Material, Composite Plating, Frictional Coefficient, Wear Characteristic, Emissivity, Conductivity, Heatsink