

Formation of Heterogeneous Metal and Metal Oxide Nano-contact Structure in CuNiPd Ternary Metallic Nanoparticles by Sub-Millisecond Laser Annealing

Guo-Heng Huang (黃國恆)¹, Che Yan (顏澈)¹, Ming-Wei Lin (林明緯)², and Tsan-Yao Chen (陳燦耀)^{1,2*}

1 Department of Engineering and System Science, National Tsing Hua University, Hsinchu 30013, Taiwan.

2 Institute of Nuclear Engineering and Science, National Tsing Hua University, Hsinchu 30013, Taiwan.

colorful032@gmail.com

Abstract

To recover the surface defects, annealing is one of the widespread techniques in material science. In recent years, a novel method of annealing is developed, that is, laser annealing which has been studied in the crystal growth and defects remove. Carbon nanotube (CNT) supported ternary metallic nanoparticles (NPs) is synthesized by wet chemical reduction method with the configuration of Cu, Ni, and Pd (namely CNP). In order to realize the effect of the energy per pulse containing to catalyst surface modification, the energy used are 1 and 10 mJ/pulse and keeping the total absorbed energy as 1 J. By cross-referencing results of physical and electrochemical inspections, we revealed that the CNP NPs will form ordered NiPd alloy which was contacted to Cu₂O after laser annealing due to the dramatic heating and cooling procedure. Gas Chromatograph (GC) results of electrochemical carbon dioxide reduction reaction shows that the amount of hydrogen was suppressed after laser annealing process. Such a scenario could be attributed to the formation of ordered NiPd structure which could inhibit the CO poisoning on the NPs surface.