FORMATION OF Ni-Cu-Ag TERMINATION USING METALLO-ORGANIC DECOMPOSITION (MOD) TECHNOLOGY AT LOW-TEMPERATURES

Hong-Ching Lin[a#], *Pang Lin*[a]
[a]*Department of Materials Science and Engineering, National Chiao Tung University, 1001 Ta Hsueh Road, Hsinchu, Taiwan 300, Repubic of China.*
linsc@itri.org.tw

Chun-An Lu[b], *Ying-Chang Hung*[b], *Tzeng Ya-Chung*[b]
[b]*Materials Research Laboratories, Industrial Technology Research Institute, Bldg. 77, 195 Section 4, Chung Hsing Road, Chutung, Hsinchu, Taiwan 310, Repubic of China.*

Sea-Fue Wang[c,]
[c]*Department of Materials and Mineral Resources Engineering, National Taipei University of Technology, 1, Sec. 3, Chung-Hsiao E. Rd., Taipei, Taiwan 106, Repubic of China.*

Ni metal electrode was widely used as internal electrode for BME MLCCs. The terminations of the BME MLCCs can be formed by coating a Cu layer and subsequently a Ag layer. The purpose of the Cu layer is to enhance the adhesion between the internal Ni electrode and the external Ag termination, by forming the Ni-Cu alloy at high temperatures (800-900°C). However, the high temperature process generally develops internal stress, which leads to the formation of inner cracks and physical defects. In this research, the Ni-Cu-Ag alloy was formed using a low temperature process from the paste containing nano-size Ni metal powders, metallo-organic decomposition (MOD) agent of copper 2-ethylhexanoate, and silver oxalate. During the heat treatment at 300°C, a large quantity of heat released from the thermal decomposition of silver oxalate, which causes the thermal decomposition of copper 2-ethylhexanoate and the melting of Ni nano-powders, and subsequently results in the formation of Ni-Cu-Ag alloy. The thermal decomposition and crystallization behavior of the MOD composite were investigated in this study. Microstructure of Cu-Ni-Ag alloy was characterized using TEM, TEM-EDX, and XRD analysis. Thermal behaviors of the pastes were obtained by DTA and TGA analysis. The TEM diffraction pattern indicates an extra diffraction point and EDX analysis shows the existence of Cu, Ag, and Ni elements in the same grain. The (111) peak in the XRD patterns shifts slightly after thermal decomposition of MOD-Cu and $Ag_2C_2O_4$ at 300°C.

References:

[1] Hansen M., Constitution of binary alloys., New York, McGraw Hill., 1958.
[2] C.J. Shih, S.J. Shih, H.C. Lin, H.H. Yeh and Y.C. Hung., Nanotechnology, 14(2003), 1014-1018.
[3] J. Feng, C.P. Zhang., J. Colloid. Interface. Sci, 293(2006), 414-420.

Figures:

[1] (a) TEM morphology of Ni-Cu-Ag Alloy after the decomposition of MOD-Cu and $Ag_2C_2O_4$, and (b) the corresponding TEM diffraction pattern (extra diffraction point for arrow indicated).

[2] (111) peaks of the XRD pattern obtained from (a) pure Ni powder, (b) Ni powder with MOD-Cu agent addition after heat treatment at 300 in N_2, (c) Ni powder with the additions of MOD-Cu agent and $Ag_2C_2O_4$ after heat treatment at 300 in N_2.

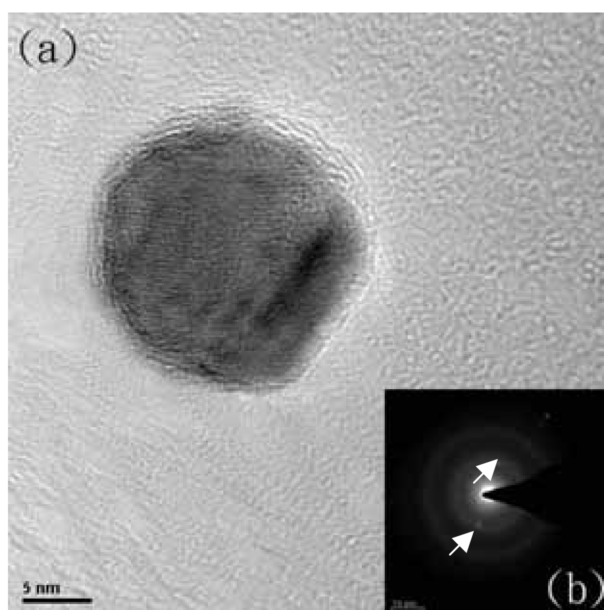

Figure 1

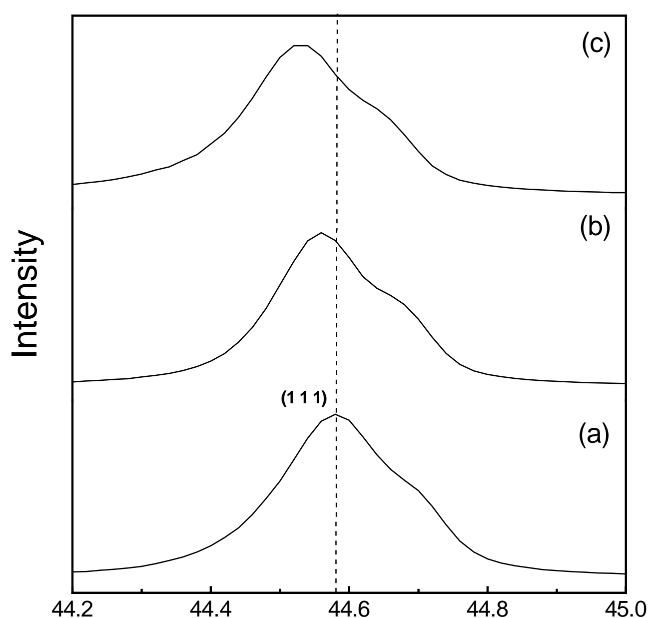

Figure 2