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Effective thermal treatment for ink-jet printed CNT field emitters

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Recently, ink-jet printed carbon nanotubes(CNTs) field emitters have been extensively studied owing to the easily scalable, eco-friendly, and high resolution. In this process, an interlayer and its thermal treatment areinevitable to improve adhesion between CNTs and substrate. In the present work, we have investigated the influences of thermal treatment conditions (ambient gases, temperature control) of interlayers on field emission characteristics. Indium and Chrome were selected as interlayers and deposited on ITO/glass substrate by thermal evaporator and RF magnetron sputter. 100x100 dot arrays (pitch=200um) was printed using 0.5 wt.% MWNTs ink(5-6 cps) and ink-jet printer. Subsequent thermal treatments and rolling were carried out for adhesion and activation of CNTs respectively. The field emission tests were carried out with diode structure. The surface morphologies and the chemical compositions of adhesion layers before/after thermal annealing were examined by FESEM, AFM, and AES. As a result, indium interlayer annealed at 400C in Ar gas induced vacuum condition by rapid thermal annealing process showed excellent emission characteristics. On the other hand, in the case of Cr interlayer, there was no significant change of field emission behavior with thermal treatment condition. It was observed that surface roughness of interlayer was closely related with the possibility of CNTs' anchoring which enhanced field emission properties. Further discussion including the electrical properties of interlayers will be presented.