NT-P002

Carbon Nanotube Heater Generating High Heat Flux

Yongpil Kang, Hyunchang Lee, Duckjong Kim

Korea Institute of Machinery and Materials

Many practical applications of carbon nanotubes(CNTs) have been proposed and there have been attempts to utilize CNT films as transparent electrodes for solar cells and displays. Our group has considered the use of the CNT film as a thin film heater (TFH) and proposed it for the first time and reported the thermal behavior of the TFH made of single walled CNTs. However, due to the relatively high electrical resistance of the CNT film, using the TFH in application areas requiring high heat flux has been a difficult problem. To overcome this obstacle, we adopted a 'branch electrodes' concept to increase the film conductance dramatically. If two branch electrodes are inserted into a TFH whose original electrical resistance is R, the total resistance will be reduced to R/9. Because of the increased aspect ratio, the resistance of each segmented TFH will be reduced to R/3. Furthermore, since they are connected in parallel, the total resistance reduces to R/9. This could be extended to n branch electrodes, and the total resistance of the film will be reduced to R/(n+1)2, if the resistance of electrodes are negligibly small. We fabricated the heaters with different number of branch electrodes. The number of branch electrodes of the fabricated heaters are 0, 2, 4, 8 and their electrical resistance are 101.4, 39.5, 20.0, 15.4 Ω , respectively. We applied 20V to each heater and monitored the temperature variations. We could achieve high heating temperature even with low voltage supply. This technique could be applied to relevant industrial applications which need high power film heater.

Keywords: Carbon nanotube film, Heater, Branch electrode, High heat flux