Carbon nanotube via interconnect technologies

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Carbon nanotubes (CNTs) offer unique properties such as highest current density exceeding 10^9 A/cm^2, ultra-high thermal conductivity as high as that of diamond, ballistic transport along the tube and extremely high mechanical strength with high aspect ratio of more than 1000. Because of these remarkable properties, they have been expected for use as future wiring materials to solve several problems, for examples, stress and electro-migration, heat removal and fabrication of a small-sized via in future LSIs. In this paper, we demonstrate present status of CNT material technologies and the potential of metallic CNT vias. In particular, we report our original catalytic nano-particle technique for controlling the diameter and density of CNTs. We have succeeded in forming a 40-nm via with the CNT density of 9×10^{11}/cm^2, which is the highest density ever reported. The low temperature CVD growth and the electrical properties of CNT vias are also discussed. Our low-temperature planar CNT via technologies are very promising for the achievement of low-resistance scaled-down CNT vias in future LSIs beyond hp32nm technology node.

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References

[1] S. Sato, et al., IEEE IITC 2006, pp.230.
[2] M. Nihei, et al., Extended Abstracts of the 2006 SSDM and Materials, 2006