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Fractal Effect Induced Giant Field Enhancement in Carbon Nanotubes and ZnO Nanowires Grown on Carbon Cloth JIANYU HUANG, KRZYSZTOF KEMPA, SUNG-HO JO, SHUO CHEN, ZHIFENG REN, Boston College, Dept. of Physics, MA — Recently we have observed an extremely strong field emission from carbon nanotubes and ZnO nanowires grown on carbon cloth, with the field enhancement factor of up to 40,000. In this work we study the origins of this effect, by investigating field emission from individual carbon nanotubes grown on carbon cloth, in a transmission electron microscope equipped with a piezo-driven scanning tunneling microscopy probe. Microscopic analysis reveals a fractal structure of some of the nanotubes, characterized by an order of magnitude smaller nanotubes branching-off the tips of bigger nanotubes (or carbon fibers). The fractal structure of the emitters implies that the field enhancement factor is a product of the field enhancement factors of individual fractal units. This explains the observed giant field enhancement.

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