

# Exhaustive mapping of Co-Mo catalytic activity against their compositions in growing SWNTs from ethanol

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In the direct growth of SWNTs on substrates by CVD methods, preparation of the catalyst nanoparticles is a crucial issue. Co-Mo binary catalysts effectively grow SWNTs either from CO [1] and from alcohol [2]. However, different values are reported as the optimum Co/Mo atomic ratio; 1/3 for the former [1] and 1/1 for the latter [2]. The structure of catalyst nanoparticles should be determined not only by the composition but also by the load of catalyst metals, and optimum conditions should depend on the CVD conditions. In this study, by using a combinatorial method [3], the SWNT growth by alcohol catalytic CVD with Co-Mo catalyst was systematically investigated and the catalytic activity was mapped against the nominal thickness of these metals. Both of these two regions showed high catalytic activity. Furthermore, at high pressure and longer time, the third region with a larger catalytic activity appeared at a large Co/Mo ratio. The mechanism for this incubation is unknown but this catalyst may be practically important in growing SWNTs at least from ethanol.

[1] J.E. Herrera, et al., J. Catal. 204, 129 (2001).

[2] M. Hu, et al., J. Catal. 225, 230 (2004).

[3] S. Noda, et al., Carbon, in press.