Synthesis of Cobalt nanowires by in-situ Environmental TEM

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In-situ environmental TEM has been used for the synthesis of cobalt (Co) nanowires encapsulated in multi walls carbon nanotubes. Co oxide nanoparticles with fractured structures have been growth in CNTs and submitted to different treatments: in-situ heating under vacuum prior and after Co reduction and in-situ hydrogen assisted thermal treatment at high pressures in an environmental TEM cell. Under vacuum, the CoO NPs diffusion is controlled by the CNTs inner residual products, whereas after reduction the fragmented structures diffuse at higher temperatures and larger NPs form. Under hydrogen flow, in the high temperatures range and at the atmospheric pressure, porous and compact Co nanowires fill the inner CNTs channels. Apart from the nanowire/CNT irradiated by the electron beam, the CNTs stand as protective shells against metallic nanowire oxidation, a key-issue for future applications.