Boron doped carbon nanotubes: Synthesis, Kinetics and Reaction mechanism

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In situ synthesis of boron doped carbon nanotubes (BCNTs) was carried out using Floating catalyst chemical vapor deposition (FCCDV) method using ethanol, ferrocene, boric acid as carbon source, catalyst precursor and boron precursor respectively. In order to understand the complexity associated with the involvement of various steps in synthesis reaction, study of kinetics and reaction mechanism is carried out. Effects of catalyst concentration, partial pressure of ethanol and synthesis temperature on the rate of formation of BCNTs, purity and size of BCNTs were studied. Surface reaction of ethanol molecules over active sites was found to be rate limiting step with activation energy is 32 kJ/mol. In order to quantify the quality and amount of doping, synthesized BCNTs were characterized by TEM, Raman spectroscopy, TGA and XPS. The synthesized BCNTs exhibit diameter in the range of ~20 to 25 nm as detected by transmission electron microscopy. This developed model can be used as for simulation, design and scale up of reactor.

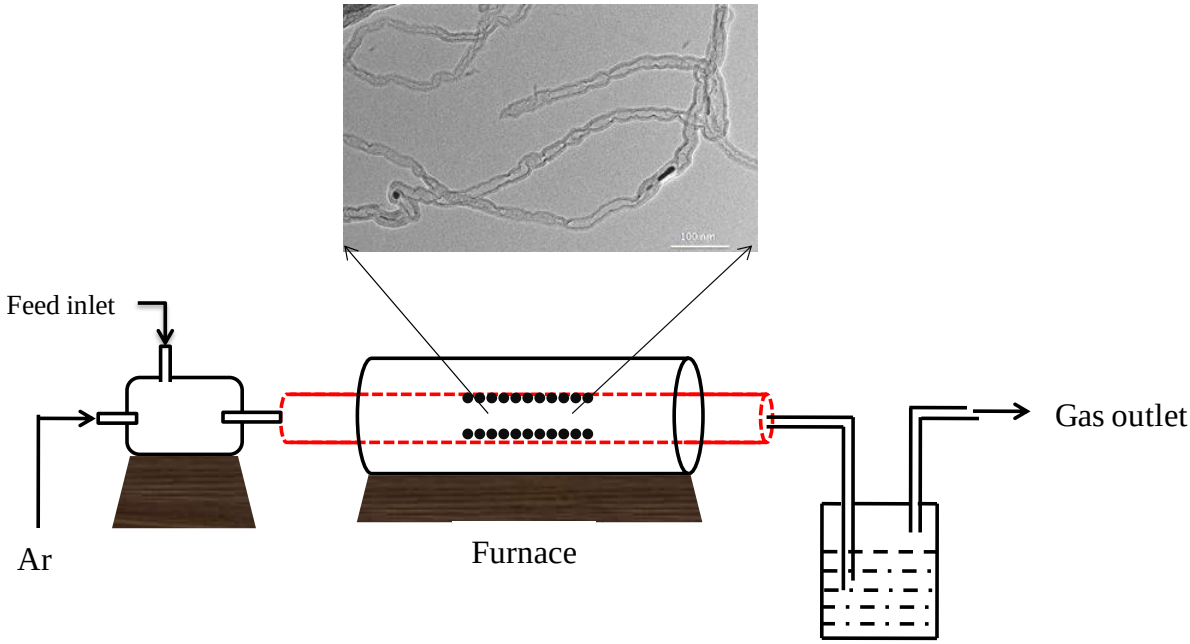

Figure. 1 Floating catalyst chemical vapor deposition synthesis of boron doped carbon nanotubes