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APPENDICES

APPENDIX A

Temperature profiles

Before doing experiments, temperature profiles in quartz tube reactor at the synthesizing temperatures of 800, 850 and 900 °C were investigated from inlet to outlet of the quartz tube with interval of 2 cm.

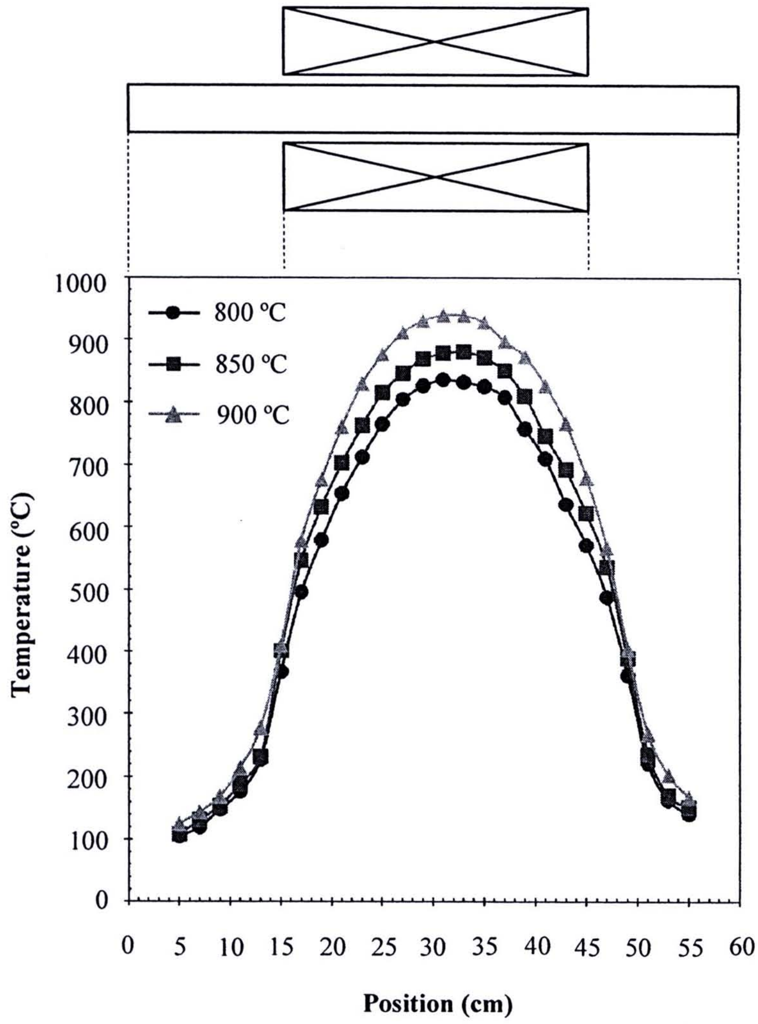

Figure A1 Temperature profiles inside the quartz tube reactor at the synthesizing temperatures of 800, 850 and 900 °C.

Temperature profiles inside the quartz tube reactor at the synthesizing temperatures of 800, 850 and 900 °C were mapped, as shown in Figure A1. Each temperature profile consisted of 3 temperature gradients along flow direction including temperature increased from the lowest to the highest (0-15 cm from the inlet) where was defined as zone 1, the temperature was the highest (15-45 cm from the inlet) where was defined as zone 2 and the temperature decreased from the highest to the lowest (45-60 cm from the inlet) where was defined as zone 3. Because indirect effect of temperature gradients and velocities gradients throughout the quartz tube reactor on the formation of the carbon nanoparticles, ZnO nanoparticles and their composites, therefore, in this work, the carbon nanoparticles, ZnO nanoparticles and their composites were studied by sampling the particles from each zone.

APPENDIX B

Calculation of partial pressure

Partial pressure of oxygen was calculated using ideal gas mixture. The mole fraction of an individual gas component in an ideal gas mixture can be expressed in terms of the component's partial pressure:

$$x_A = \frac{n_A}{n} \tag{A1}$$

$$p_A = x_A \times p \tag{A2}$$

where :

	n	=	total moles of the gas mixture
	p_A	=	partial pressure of gas component A in gas mixture
	n_A	=	mole of gas component A in gas mixture
	x_A	=	mole fraction of gas component A in gas mixture
	p	=	pressure of gas mixture

For example, in case of 100 mL/min of oxygen and 200 mL/min of nitrogen flow rate

$$n_{O_2} = \frac{0.1(L/min)\times 1.42(g/L)}{32(g/mole)}$$

$$= 4.44 \times 10^{-3} \text{ mole/min}$$

$$n_{N_2} = \frac{0.2(L/min)\times 1.25(g/L)}{28(g/mole)}$$

$$= 8.93 \times 10^{-3} \text{ mole/min}$$

$$n = 1.33 \times 10^{-2} \text{ mole/min}$$

$$x_{O_2} = \frac{4.44\times 10^{-3}(mole/min)}{1.33\times 10^{-2}(mole/min)}$$

$$= 0.33$$

If assumption was partial pressure inside the reactor is 1 atm. Therefore, partial pressure of gas component is equal to mole fraction.

APPENDIX C

Publications

Journal:

Publications Authored by J. Klanwan:

Klanwan, J., Akrapattangkul, N., Pavarajarn, V., Seto, T., Otani, Y., and Charinpanitkul, T. Single-step synthesis of MWCNT/ZnO nanocomposite using co-chemical vapor deposition method. Materials Letters 64 (2010): 80-82.

Klanwan, J., Seto, T., Furukawa, T., Otani, Y., Charinpanitkul, T., Kohno, M., and Hirasawa, M. Generation and size classification of single-walled carbon nanotube aerosol using atmospheric pressure pulsed laser ablation (AP-PLA). Journal of Nanoparticle Research 12 (2010): 2747-2755.

Publications Co-Authored by J. Klanwan:

Charinpanitkul, T., Sano, N., Puengjinda, P., **Klanwan, J.**, Akrapattangkul, N., and Tanthapanichakoon W. Naphthalene as an alternative carbon source for pyrolytic synthesis of carbon nanostructures. Journal of Analytical and Applied Pyrolysis 86 (2009): 386-390.

Proceeding:

Klanwan, J., Ratchahat, S., Soottitantawat, A., Kohno, M., Furukawa , T., Seto T., Otani, Y., and Charinpanitkul T. Formation of multi-walled carbon nanotubes induced by nickel nanoparticles using low-pressure chemical vapor deposition technique. Proceeding of the 17^{th} Regional Symposium on Chemical Engineering, Queen Sirikit National Conventional Center, Bangkok, Thailand, November 22-23, 2010: MSE 495.

VITA

Miss Jiraporn Klanwan was born in April 18, 1984. She studied in secondary educations at Bangmulnak Phoomiwitthayakom School, Phichit. In 2006, she graduated Bachelor Degree of Engineering (Chemical Engineering) from King Mongkut's Institute of Technology Ladkrabang. After that, she continued to study in Doctoral degree in Center of Excellence in Particle Technology at Department of Chemical Engineering, Faculty of Engineering, Chulalongkorn University.