APPENDICES

APPENDIX A

IMAGES OF INSTRUMENT

A.1. Flame Spray Pyrolysis

Figure A.1. Flame Spray Pyrolysis Equipment at The NRL Research Laboratory Chiang Mai University

A.2. X-ray diffractometer (XRD)

Figure A.2. X-Ray Diffractometer, Bruker D8 advanced, Germany

A.3. Scanning Electron Microscopy (SEM) and Energy Dispersive X-Ray Spectrometry (EDS)

Figure A.3. Scanning Electron Microscopy & Energy Dispersive X-Ray Spectrometry, JSM-6335F, JEOL, Japan

A.4. Transmission Electron Microscopy (TEM)

Figure A.4. Transmission Electron Microscopy, JSM-2010, JOEL, Japan

A.5. Surface area analyzer (BET)

Figure A.5. Surface area analysis, Quantachrome Autosorb 1 MP, USA

APPENDIX B

JCPDS INFORMATION

B.1. JCPDS File No. 79-205 of Zinc Oxide

[79-205] PDF-2 Sets 1-86 Quality: C Wavelength: 1.540598

Zinc Oxide

Zn O

Rad.: CuKα1 (1.54060)

Filter:

d-sp: calculated

I/Icor.: 5.65

Cutoff: 17.7

Int.: calculated

Sys.: Hexagonal

S.G.: P63 mc (136)

V(redu): 47.2

a: 3.24170 (80)	b:	c: 5.18760 (80)	C: 1.6003	
A:	B:	C:	Z: 2	mp:

Dx: 5.734

Dm:

SS/FOM: F13 = 999.9 (.0001, 13)

ICSD: 065119

Ref.: Albertsson, J., Abrahams, S.C., Kvick, A., Acta Crystallogr., Sec. B: Structural Science, 45, (1989), 34

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ea:

nwB:

ey:

Sign:

2V:

REM TEM 20. // At least one TF implausible.

Hanawalt: 2.47/G 2.81/G 2.59/G 1.62/G 1.47/G 1.37/G 1.91/G 1.36/G 1.09/8 1.40/4

Max-d: 2.81/G 2.59/G 2.47/G 1.91/G 1.62/G 1.47/G 1.40/G 1.37/G 1.36/G 1.30/2

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d[A]	2Theta	Int.	h k l
2.8074	31.850	557	1 0 0
2.5938	34.552	410	0 0 2
2.4690	36.358	999	1 0 1
1.9051	47.700	218	1 0 2
1.6209	56.751	318	1 1 0
1.4723	63.093	284	1 0 3
1.4037	66.564	43	2 0 0
1.3745	68.168	235	1 1 2
1.3550	69.291	116	2 0 1
1.2969	72.876	19	0 0 4
1.2345	77.214	37	2 0 2
1.1773	81.729	19	1 0 4
1.0898	89.952	78	2 0 3

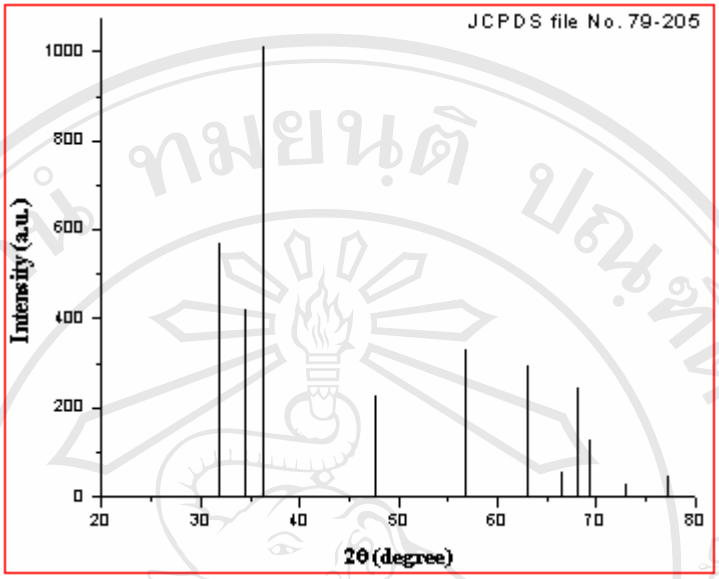

Figure B.1. X-ray diffraction pattern of zinc oxide

B.2. JCPDS File No. 74-1225 of Magnesium Oxide

[74-1225] PDF-2 Sets 1-86 Quality: C Wavelength: 1.540598

Magnesium Oxide

Periklase

Mg O

Rad.: CuKα1 (1.54060)

Filter:

d-sp: calculated

I/Icor.: 3.04

Cutoff: 17.7

Int.: calculated

Ref.: Calculated from ICSD using POWD-12++, (1997)

Sys.: Cubic

S.G.: F23 (196)

V(redu): 18.7

a: 4.22000 (2000) b: c:

A: B: C: Z: 4 mp:

Dx: 3.562

Dm:

SS/FOM: F5 = 999.9 (.0001, 5)

ICSD: 026958

Ref.: Gerlach, W., Z. Phys., 9, (1922), 184

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ea:

nwB:

ey:

Sign:

2V:

No R Value given. // At least one TF missing.

Hanawalt: 2.11/G 1.49/G 2.44/G 1.22/G 1.27/3 0.00/1 0.00/1 0.00/1 0.00/1 0.00/1

Max-d: 2.44/G 2.11/G 1.49/G 1.27/3 1.22/G 0.00/1 0.00/1 0.00/1 0.00/1 0.00/1

d[A]	2Theta	Int.	h k l
2.4364	36.862	116	1 1 1
2.1100	42.824	999	2 0 0
1.4920	62.167	455	2 2 0
1.2724	74.515	25	3 1 1
1.2182	78.443	111	2 2 2

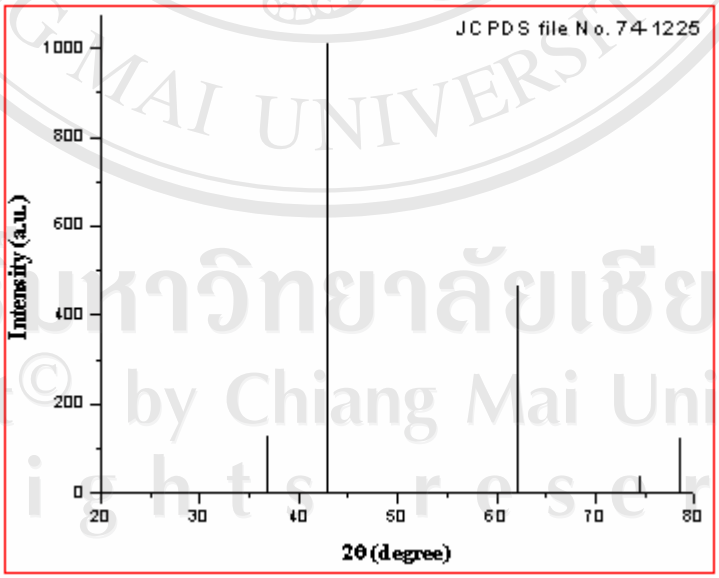

Figure B.1. X-ray diffraction pattern of magnesium oxide

APPENDIX C

CALCULATION

Particle Size (d_{BET})

The average BET equivalent particle size (d_{BET}) was calculated using

$$d_{BET} = \frac{6}{SSA_{BET}\,\rho_{sample}}$$

Where:

SSA_{BET} is specific surface area

ρ_{sample} is the density of sample

1. Pure ZnO

The specific surface area of pure ZnO is 88.85 m^2/g and ρ_{ZnO} is 5.61 x 10^3 kg/m^3

$$d_{BET} = \frac{6}{88.85\ m^2/g\ x\ 5.61x10^3\ kg/m^3}$$

$$= 12.04 \text{ nm}$$

2. Pure MgO

The specific surface area of pure MgO is 198.38 m^2/g and ρ_{MgO} is 3.58 x 10^3 kg/m^3

$$d_{BET} = \frac{6}{198.38\ m^2/g\ x\ 3.58x10^3\ kg/m^3}$$

$$= 8.45 \text{ nm}$$

3. 5 wt% ZnO/MgO nanocomposites

The specific surface area of 5 wt% ZnO/MgO nanocomposites is 162.78 m^2/g

$$d_{BET} = \frac{6}{(162.78 m^2/g x 5.61 x 10^3\ kg/m^3 x 95/100)+(162.78 m^2/g x 3.58 x 10^3 kg/m^3 x 5/100)}$$

$$= 6.70 \text{ nm}$$

4. 10 wt% ZnO/MgO nanocomposites

The specific surface area of 10 wt% ZnO/MgO nanocomposites is 177.99 m^2/g

$$d_{BET} = \frac{6}{(177.99 m^2/g\ x\ 5.61 x 10^3\ kg/m^3 x 90/100)+(177.99 m^2/g\ x\ 3.58 x 10^3\ kg/m^3 x 10/100)}$$

$$= 6.24 \text{ nm}$$

5. 15 wt% ZnO/MgO nanocomposites

The specific surface area of 15 wt% ZnO/MgO nanocomposites is 181.73 m^2/g

$$d_{BET} = \frac{6}{(181.73 m^2/g x 5.61 x 10^3\ kg/m^3 x 85/100)+(181.73 m^2/g x 3.58 x 10^3\ kg/m^3 x 15/100)}$$

$$= 6.23 \text{ nm}$$

6. 20 wt% ZnO/MgO nanocomposites

The specific surface area of 20 wt% ZnO/MgO nanocomposites is 146.84 m^2/g

$$d_{BET} = \frac{6}{(146.84 m^2/g x 5.61 x 10^3 kg/m^3 x 80/100)+(146.84 m^2/g x 3.58 x 10^3 kg/m^3 x 20/100)}$$

$$= 7.86 \text{ nm}$$

CURRICULUM VITAE

Name	Miss Thanittha Samerjai
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Scholarship	The Center of Excellence for Innovation in Chemistry, (PERCH-CIC), Thailand, 2007-2009
Working experience	Work as a teaching assistant in the Chemistry Laboratory courses, Department of Chemistry, Faculty of Science, Chiang Mai University, Thailand, 2007.

Publications and Presentations

Journal Article

1. Samerjai T., Liewhiran C., Phanichphant S. Characterization of ZnO/MgO Nanocomposites Synthesized by Flame Spray Pyrolysis. J. Microscopy Society of Thailand, Accepted for Publication.

Conference papers/Presentations

1. Samerjai T., Liewhiran C., Phanichphant S. Characterization of ZnO/MgO Nanocomposites Synthesized by Flame Spray Pyrolysis., Poster Presentation, The 26th Annual Conference of Microscopy Society of Thailand, 28-30 January 2009, The Empress Hotel, Chiang Mai, Thailand.
2. Samerjai T., Liewhiran C., Phanichphant S. Synthesis of MgO/ZnO Nanocomposites by Flame Spray Pyrolysis., Poster Presentation, The 4th Advanced Materials and Nanotechnology Conference (AMN-4), 8-12 February 2009, University of Otago, Dunedin, New Zealand.