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APPENDICES

Appendix A Experimental Data of Gas Calibration of GC-8A

1. Methane

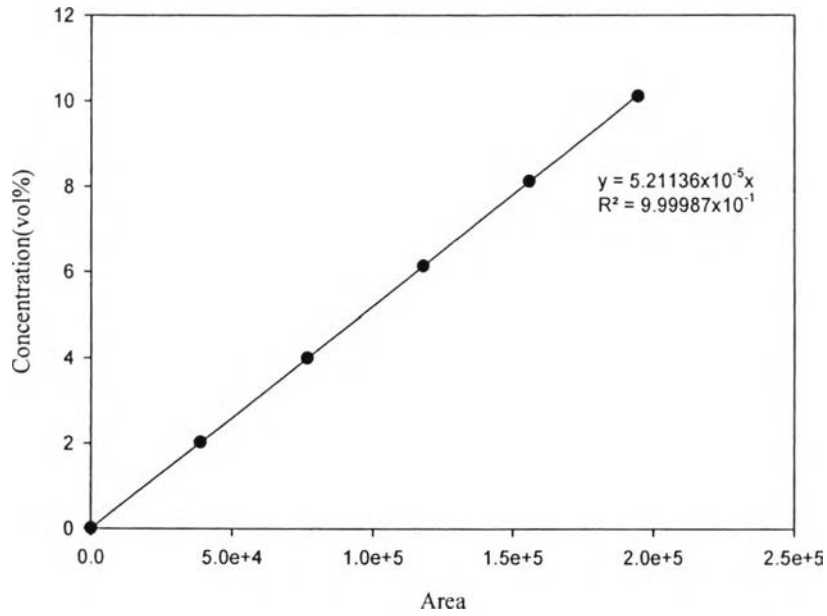


Figure A1 Relationship between area and concentration of methane.

2. Oxygen

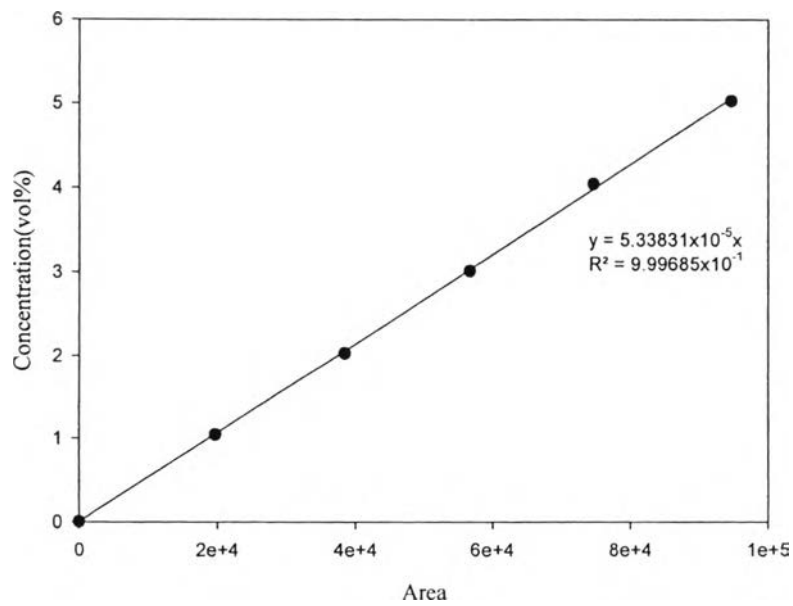


Figure A2 Relationship between area and concentration of oxygen.

3. Hydrogen

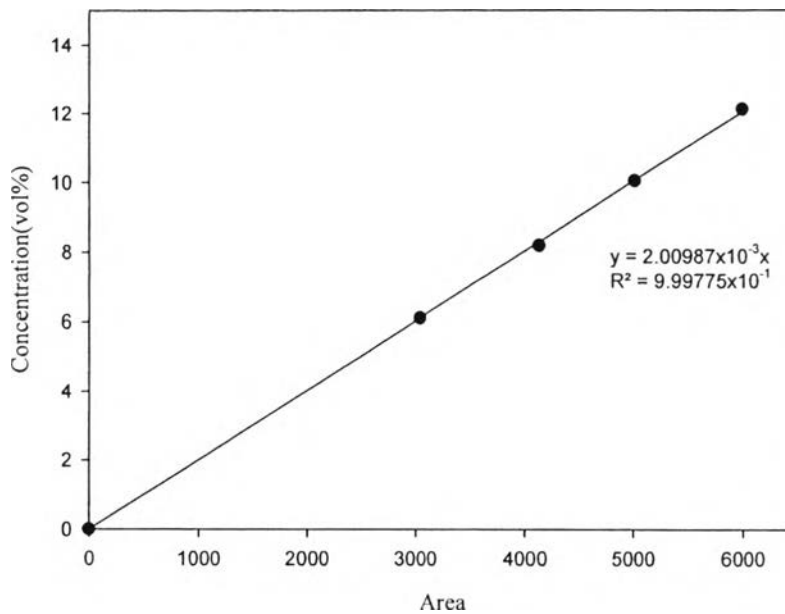


Figure A3 Relationship between area and concentration of hydrogen.

4. Carbon monoxide

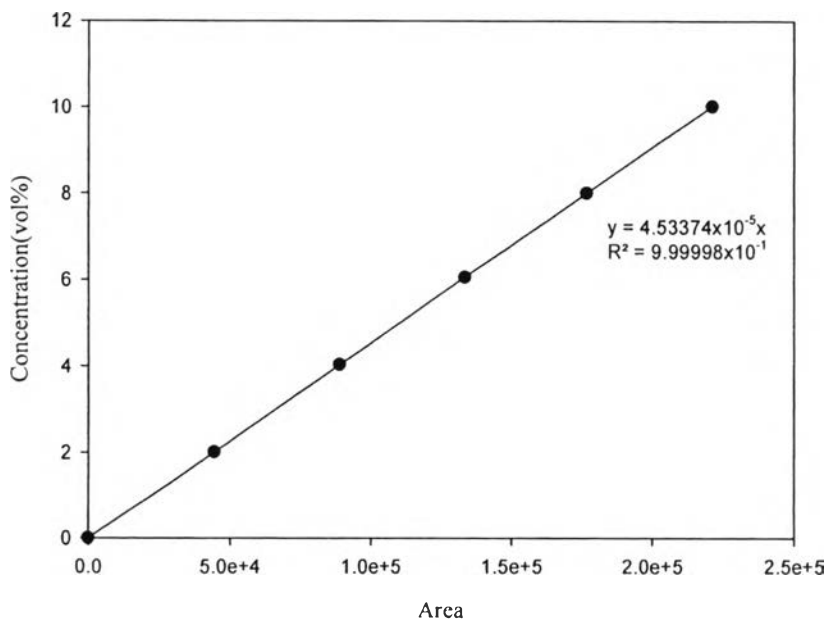


Figure A4 Relationship between area and concentration of carbon monoxide.

5. Carbon dioxide

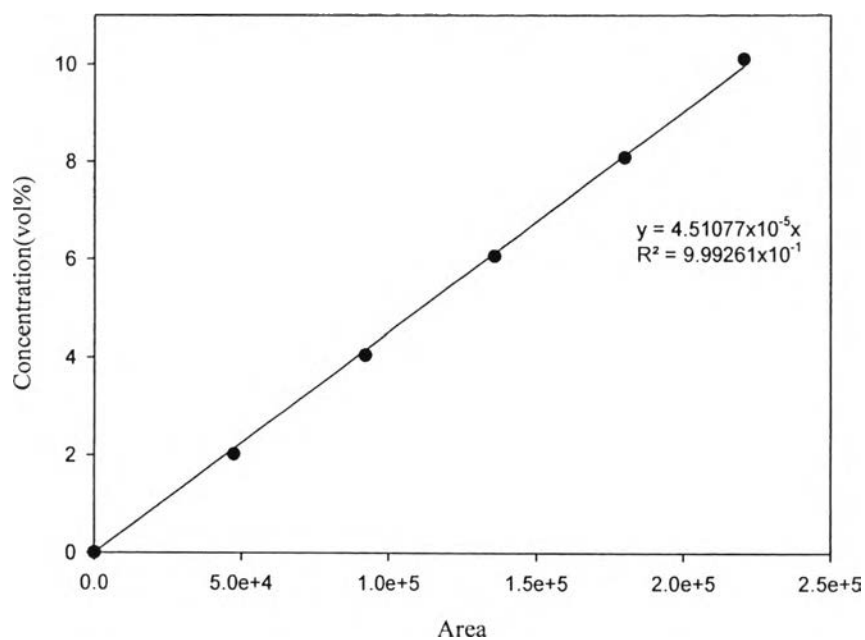


Figure A5 Relationship between area and concentration of carbon dioxide.

6. Nitrogen

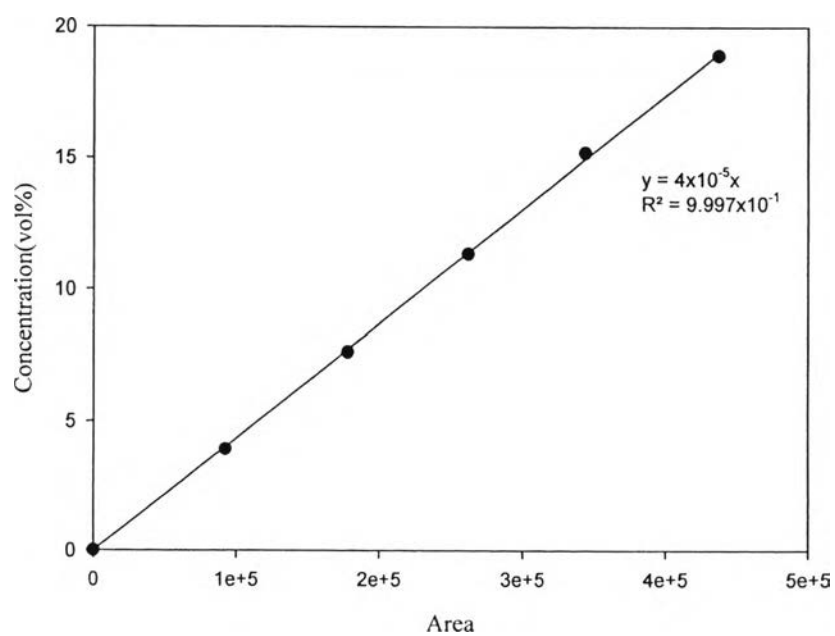


Figure A6 Relationship between area and concentration of nitrogen.

Appendix B Experimental Data of Flow Meter Gas Calibration of Brooks 5850E Mass Flow Controllers

1. Methane

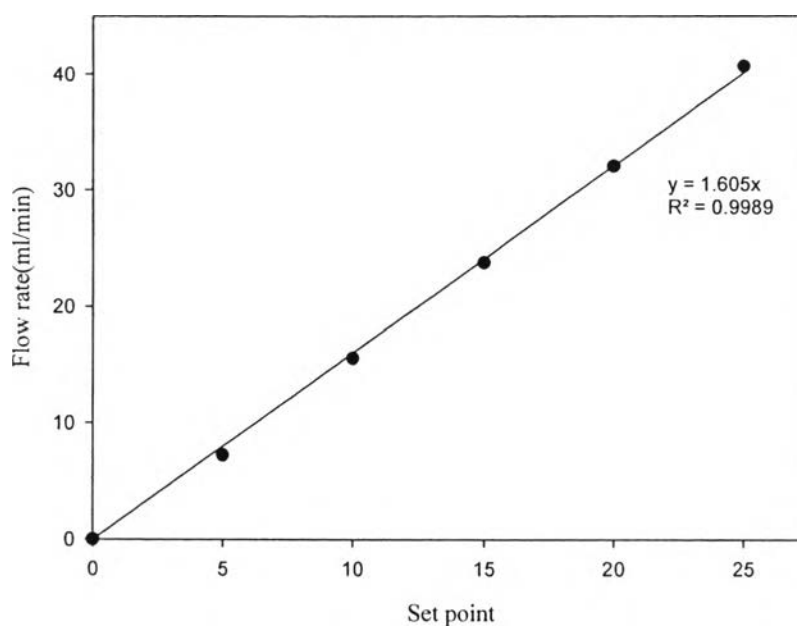


Figure B1 Relationship between SP and flow rate of methane.

2. Air

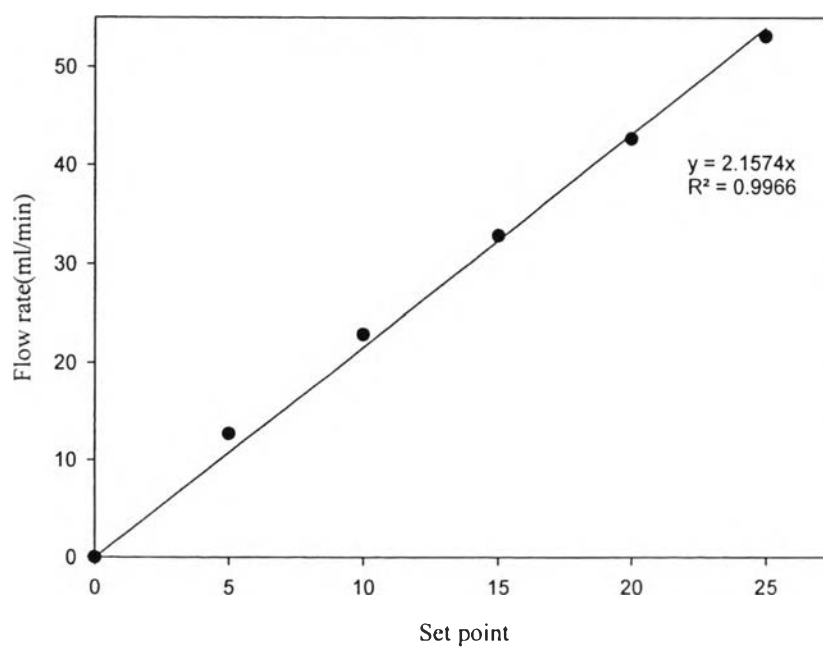


Figure B2 Relationship between SP and flow rate of air.

3. Helium

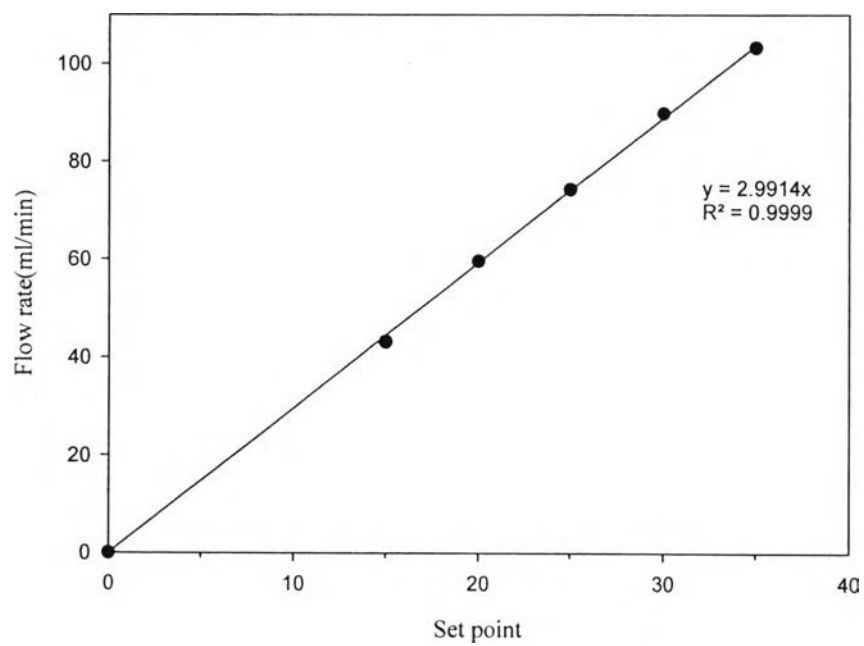


Figure B3 Relationship between SP and flow rate of helium.

Appendix C Experimental Data of Catalytic Activity Tests for MPO

Table C1 Catalytic activity test of Ni/CZO catalyst

Temperature (°C)	X _{CH₄} (%)	X _{O₂} (%)	S _{H₂} (%)	S _{CO} (%)
400	2.97	12.66	0.00	0.00
450	10.20	43.39	0.00	0.00
500	20.28	85.56	0.00	0.00
550	24.67	99.64	0.00	0.00
600	80.36	99.99	89.67	90.11
650	90.13	99.99	94.26	95.29
700	96.52	99.99	94.13	97.26
750	97.31	99.99	94.35	98.72
800	98.19	99.99	94.50	99.48

Table C2 Catalytic activity test of Ni-1%Mg/CZO catalyst

Temperature (°C)	X _{CH₄} (%)	X _{O₂} (%)	S _{H₂} (%)	S _{CO} (%)
400	3.29	15.03	0.00	0.00
450	11.11	44.54	0.00	0.00
500	19.83	80.74	0.00	0.00
550	24.06	94.03	0.00	0.00
600	25.54	99.65	0.00	0.00
650	89.56	99.99	93.27	95.19
700	94.66	99.99	92.57	97.36
750	98.12	99.99	91.81	98.57
800	98.77	99.99	91.75	99.32

Table C3 Catalytic activity test of Ni-3%Mg/CZO catalyst

Temperature (°C)	X _{CH₄} (%)	X _{O₂} (%)	S _{H₂} (%)	S _{CO} (%)
400	2.04	8.63	0.00	0.00
450	7.11	30.54	0.00	0.00
500	13.85	64.10	0.00	0.00
550	18.59	86.50	0.00	0.00
600	21.27	97.66	0.00	0.00
650	21.02	99.99	0.00	0.00
700	92.07	99.99	95.31	98.14
750	98.83	99.99	95.18	99.01
800	98.32	99.99	94.8573	99.52

Table C4 Catalytic activity test of Ni-5%Mg/CZO catalyst

Temperature (°C)	X _{CH₄} (%)	X _{O₂} (%)	S _{H₂} (%)	S _{CO} (%)
400	4.28	14.17	0.00	0.00
450	6.85	32.19	0.00	0.00
500	16.52	82.67	0.00	0.00
550	20.80	98.06	0.00	0.00
600	22.12	99.99	0.00	0.00
650	21.75	99.99	0.00	0.00
700	22.16	99.99	0.00	0.00
750	97.49	99.99	94.81	98.57
800	98.28	99.99	94.53	99.28

Table C5 Catalytic activity test of 1%Mg-Ni/CZO catalyst

Temperature (°C)	X _{CH₄} (%)	X _{O₂} (%)	S _{H₂} (%)	S _{CO} (%)
400	0.42	9.31	0.00	0.00
450	5.0630	32.73	0.00	0.00
500	15.49	81.68	0.00	0.00
550	18.58	99.99	0.00	0.00
600	17.66	99.99	0.00	0.00
650	92.65	99.99	94.78	95.54
700	98.45	99.99	95.25	96.84
750	99.07	99.99	95.68	97.36
800	99.18	99.99	95.51	98.08

Table C6 Catalytic activity test of 3%Mg-Ni/CZO catalyst

Temperature (°C)	X _{CH₄} (%)	X _{O₂} (%)	S _{H₂} (%)	S _{CO} (%)
400	0.66	0.30	0.00	0.00
450	3.01	7.05	0.00	0.00
500	8.14	33.74	0.00	0.00
550	18.39	88.40	0.00	0.00
600	21.13	99.99	0.00	0.00
650	20.45	99.99	0.00	0.00
700	20.56	99.99	0.00	0.00
750	19.89	99.99	0.00	0.00
800	98.52	99.99	95.34	98.31

Table C7 Catalytic activity test of 5%Mg-Ni/CZO catalyst

Temperature (°C)	X _{CH₄} (%)	X _{O₂} (%)	S _{H₂} (%)	S _{CO} (%)
400	0.9835	2.87	0.00	0.00
450	1.7630	2.23	0.00	0.00
500	2.41	19.94	0.00	0.00
550	9.62	56.16	0.00	0.00
600	17.56	93.04	0.00	0.00
650	19.35	98.90	0.00	0.00
700	19.92	99.99	0.00	0.00
750	19.99	99.99	0.00	0.00
800	98.57	99.99	95.87	97.68

Appendix D Experimental Data of Stability Tests for MPO

Table D1 Stability test of Ni/CZO catalyst

Time (hr)	X_{CH_4} (%)	X_{O_2} (%)	S_{H_2} (%)	S_{CO} (%)
1	97.59	99.99	96.86	98.0374
2	97.51	99.99	96.51	98.0927
3	97.55	99.99	96.40	98.1608
4	97.77	99.99	98.40	97.5771
5	98.62	99.99	97.64	96.9178
6	98.47	99.99	97.67	96.6085

Table D2 Stability test of Ni-1%Mg/CZO catalyst

Time (hr)	X_{CH_4} (%)	X_{O_2} (%)	S_{H_2} (%)	S_{CO} (%)
1	97.46	99.99	95.59	98.44
2	97.62	99.99	95.58	98.43
3	97.64	99.99	95.28	98.44
4	98.19	99.99	95.93	98.03
5	97.91	99.99	96.78	97.93
6	97.99	99.99	96.94	97.87

Table D3 Stability test of Ni-3%Mg/CZO catalyst

Time (hr)	X_{CH_4} (%)	X_{O_2} (%)	S_{H_2} (%)	S_{CO} (%)
1	97.03	99.99	95.96	98.40
2	97.29	99.99	95.53	98.26
3	97.31	99.99	95.67	98.14
4	97.25	99.99	95.06	98.25
5	96.41	99.99	96.11	98.09
6	96.21	99.99	96.84	97.70

Table D4 Stability test of 1%Mg-Ni/CZO catalyst

Time (hr)	X_{CH_4} (%)	X_{O_2} (%)	S_{H_2} (%)	S_{CO} (%)
1	97.46	99.99	95.84	98.28
2	97.53	99.99	95.31	98.12
3	97.12	99.99	96.01	97.94
4	97.32	99.99	95.82	96.64
5	96.86	99.99	95.83	96.43
6	96.38	99.99	95.85	96.02

Table D5 Stability test of 3%Mg-Ni/CZO catalyst

Time (hr)	X _{CH₄} (%)	X _{O₂} (%)	S _{H₂} (%)	S _{CO} (%)
1	97.14	99.99	95.25	98.48
2	97.21	99.99	95.13	98.27
3	97.13	99.99	95.70	98.19
4	97.28	99.99	96.30	97.20
5	96.56	99.99	96.64	96.75
6	96.48	99.99	96.59	96.64

Appendix E Experimental Data of Stability Tests for MPO**Table E1** Stability test of 3%Mg-Ni/CZO catalyst for 18 hrs

Time (hr)	X _{CH₄} (%)	X _{O₂} (%)	S _{H₂} (%)	S _{CO} (%)
1	98.12	99.99	96.46	98.25
7	97.96	99.99	96.35	98.01
8	97.79	99.99	96.03	97.67
9	97.92	99.99	96.67	97.48
10	97.31	99.99	96.13	97.25
11	97.94	99.99	96.21	96.85
12	97.68	99.99	95.95	96.44
13	97.75	99.99	95.88	96.44
14	97.93	99.99	95.29	96.37
15	97.66	99.99	95.88	95.71
16	97.75	99.99	95.43	95.61
17	97.83	99.99	95.58	95.66
18	97.96	99.99	95.60	95.43

CURRICULUM VITAE

Name: Ms.Kittiya Arunsingkarat

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University Education:

2006-2010 Bachelor Degree of Engineering in major of Petrochemical and polymeric material , Faculty of Engineering and Industrial technology, Silpakorn University, Thailand.

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Working Experience:

2008 Position: Trainee (2 months)

Company name: Teijin (Thailand) Co.Ltd.

Proceedings:

1. Arunsingkarat, K.; Rirksomboon, T.; Meeyoo, V.; Pengpanich, S. (2011, December 4-8) Catalytic Partial Oxidation of Methane over NiO-MgO/Ce_{0.75}Zr_{0.25}O₂ Mixed Oxide Catalysts: Effects of Low Mg Incorporation. C&FC 2011 Catalysis and Fine Chemicals 2011 International symposium on catalysis and fine chemicals 2011 , Nara , Japan.
2. Arunsingkarat, K.; Rirksomboon, T.; Meeyoo, V.; Pengpanich, S. (2012, April 24) Catalytic Partial Oxidation of Methane over NiO-MgO/Ce_{0.75}Zr_{0.25}O₂ Mixed Oxide Catalysts: Effects of Low Mg content and its incorporated sequence. Proceedings of The 18th PPC Symposium on Petroleum, Petrochemicals, and Polymers, Bangkok, Thailand.

