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# APPENDIES

## Appendix A XRD Patterns of Ag-Loaded Catalysts at Various Ag Loadings

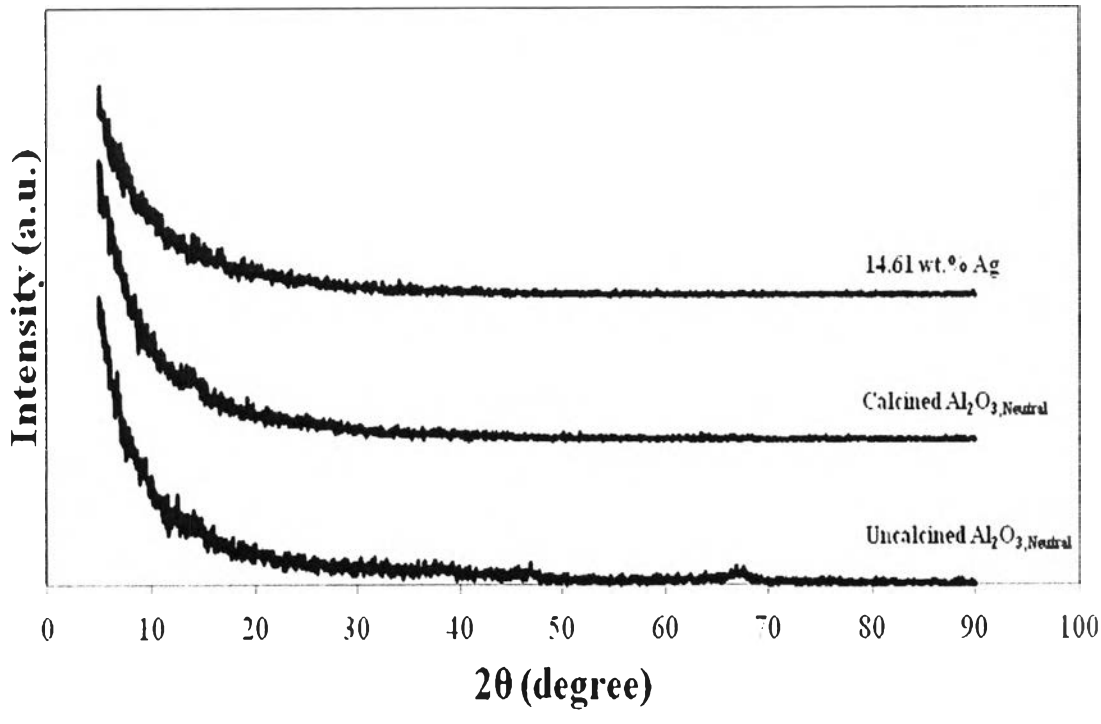


**Figure A1** XRD patterns of Ag-loaded $Al_2O_{3,Neutral}$ catalysts.

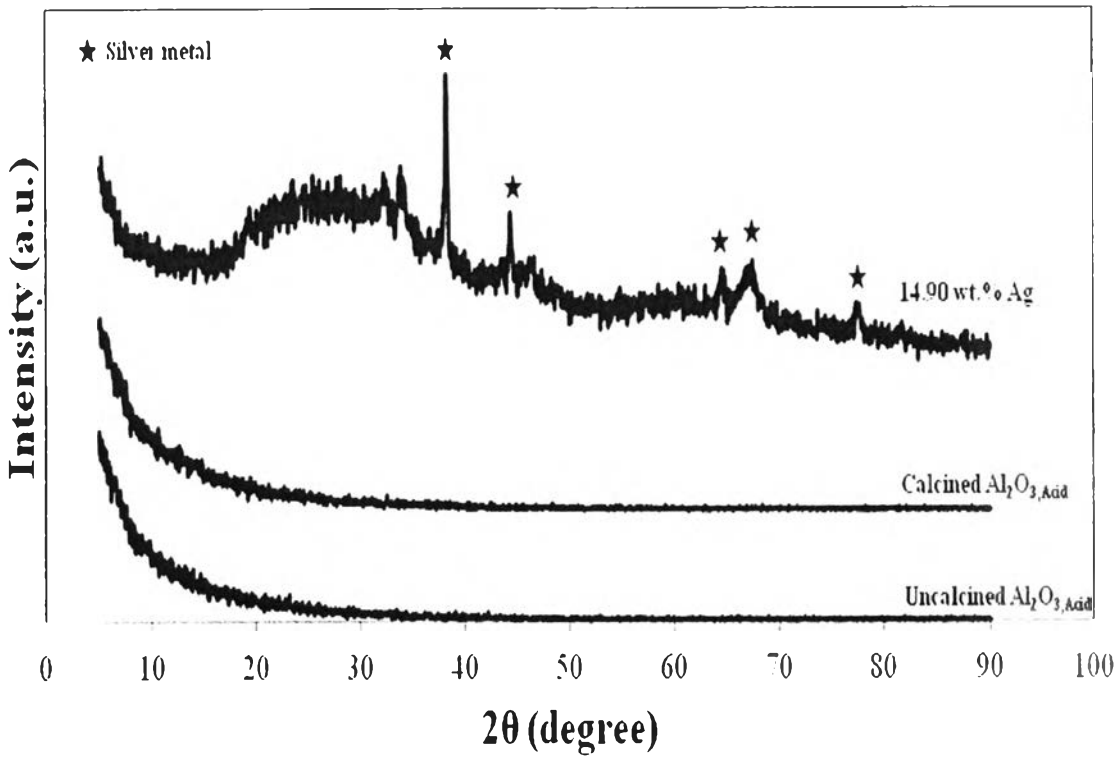


**Figure A2** XRD patterns of Ag-loaded $Al_2O_{3,Acid}$ catalysts.

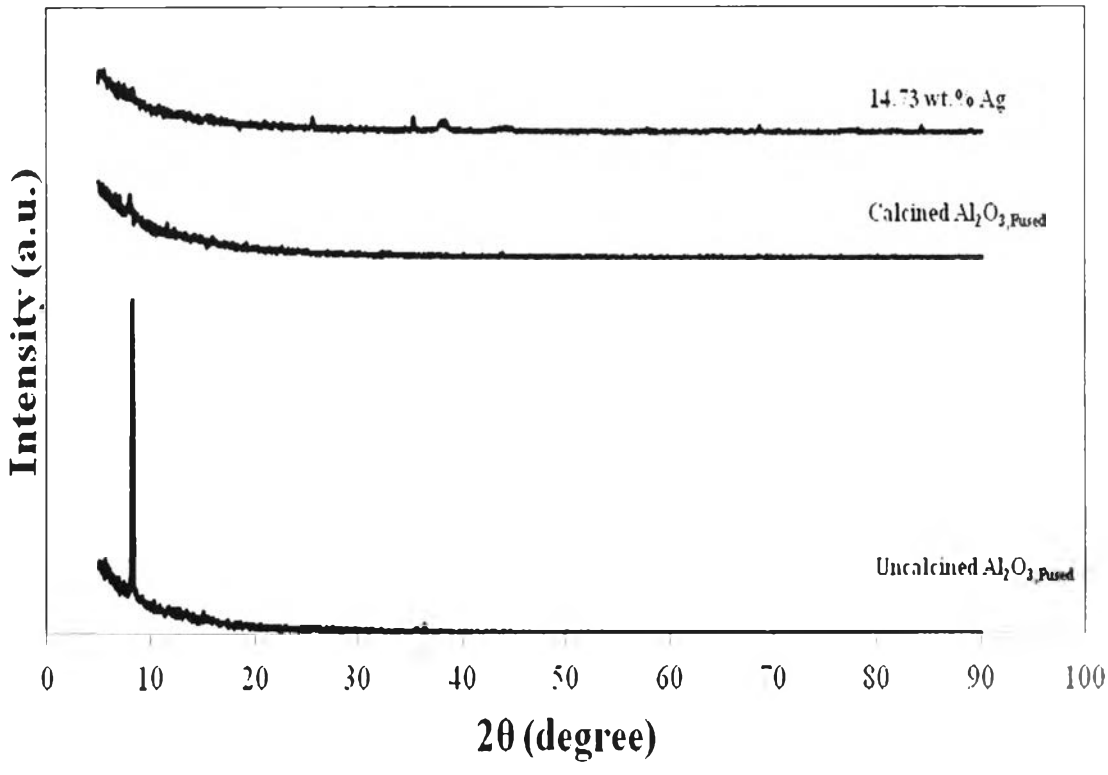


**Figure A3** XRD patterns of Ag-loaded $Al_2O_{3,Fused}$ catalysts.

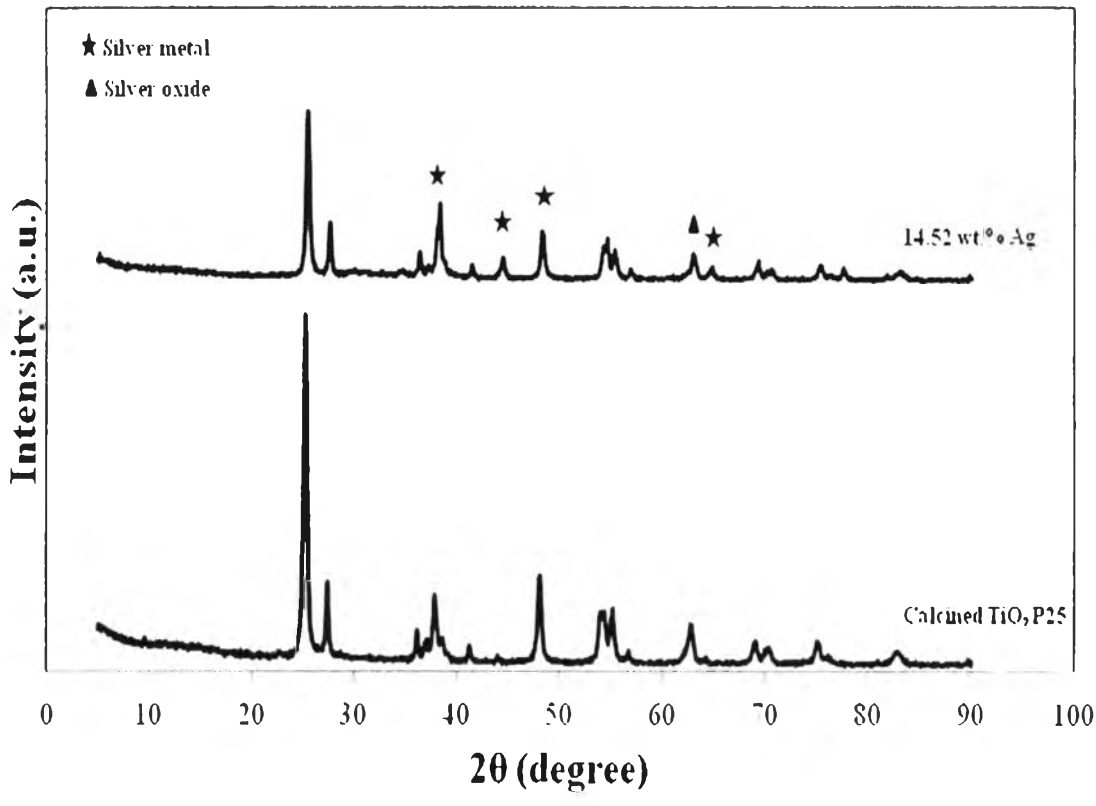


**Figure A4** XRD patterns of Ag-loaded $TiO_2$ P25 catalysts.

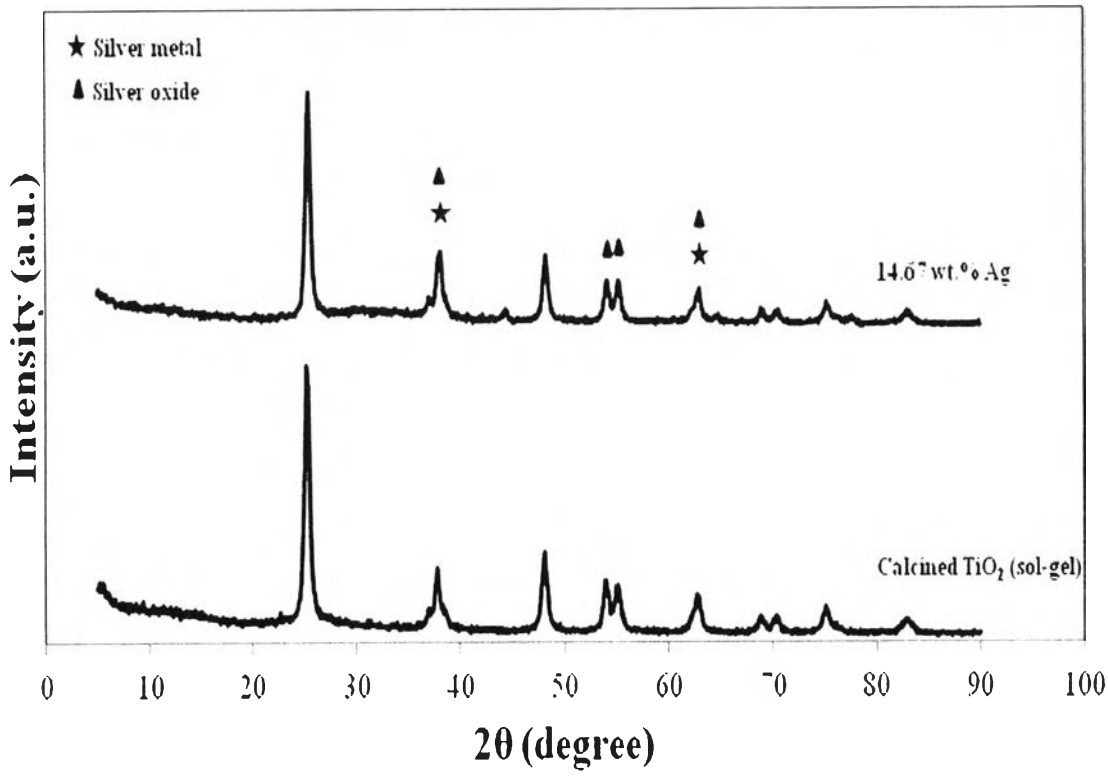


**Figure A5** XRD patterns of Ag-loaded $TiO_2$ (sol-gel) catalysts.

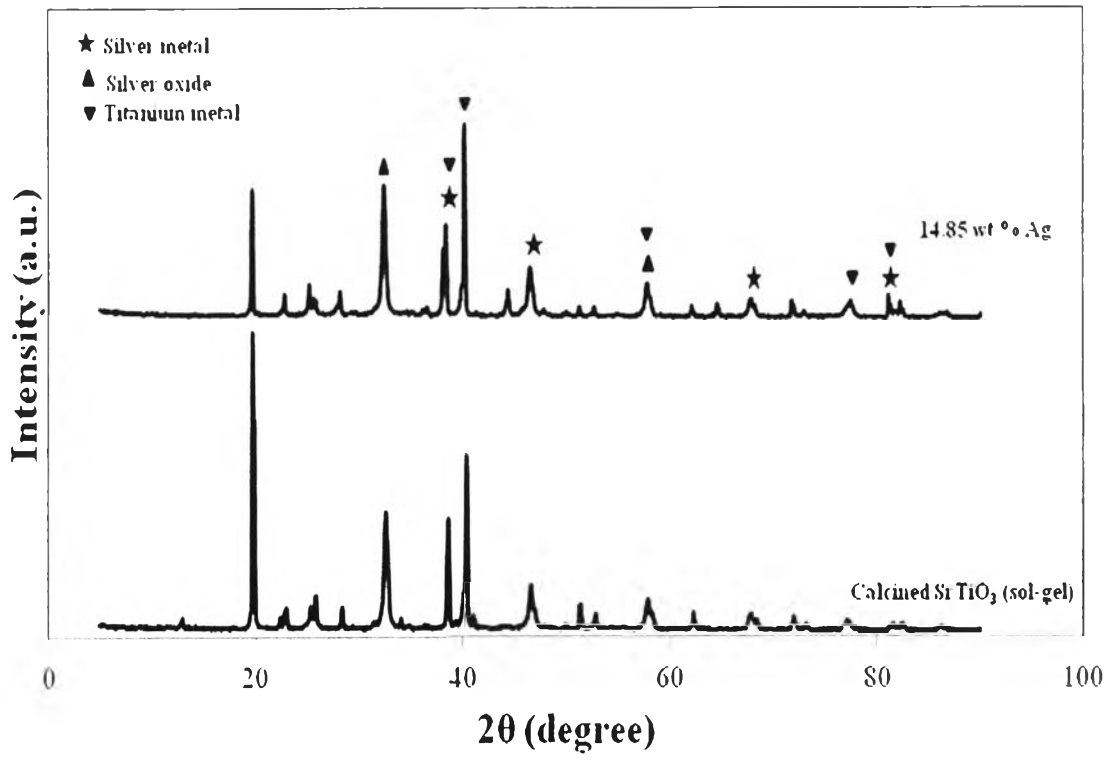


**Figure A6** XRD patterns of Ag-loaded $SrTiO_3$ (sol-gel) catalysts.

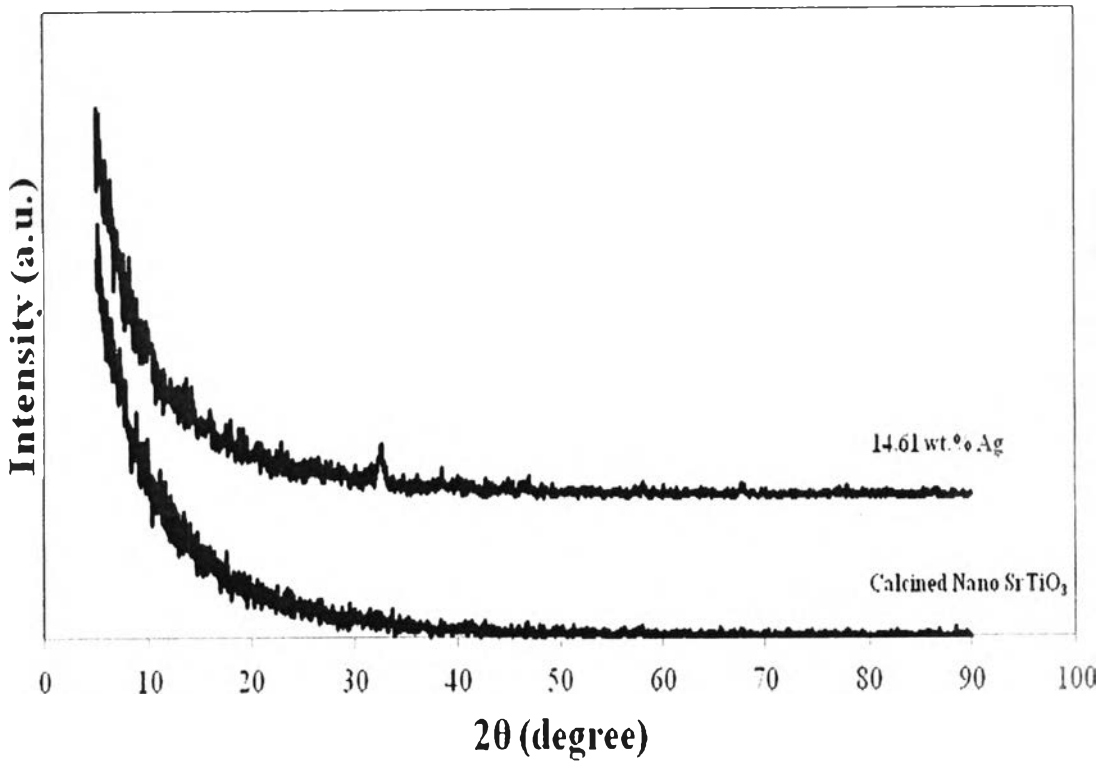


**Figure A7** XRD patterns of Ag-loaded nano $SrTiO_3$ catalysts.

## Appendix B The Catalytic Activity of Ethylene Epoxidation over Various Ag-Loaded Catalysts

**Table B1** The catalytic activity of ethylene epoxidation over Ag-loaded $Al_2O_3$ C catalysts prepared with various Ag loadings at $O_2$:$C_2H_4$ ratio of 1:1, space velocity of 6,000 $h^{-1}$, and different reaction temperatures

| Ag loading (wt.%) | Temperature (°C) | $C_2H_4$ conversion (%) | EO selectivity (%) | EO yield (%) |
|---|---|---|---|---|
| 9.85 | 180 | 0.154 | 100 | 0.154 |
| | 200 | 0.241 | 97.09 | 0.234 |
| | 225 | 0.699 | 90.75 | 0.634 |
| | 250 | 1.321 | 79.31 | 1.048 |
| | 275 | 2.326 | 16.19 | 0.380 |
| | 290 | 2.967 | 0 | 0 |
| 13.16 | 200 | 0.659 | 74.90 | 0.494 |
| | 225 | 0.777 | 96.46 | 0.750 |
| | 250 | 1.350 | 89.85 | 1.213 |
| | 275 | 3.905 | 86.69 | 3.385 |
| | 290 | 4.897 | 27.01 | 1.323 |
| 14.79 | 200 | 0.542 | 76.89 | 0.417 |
| | 225 | 1.784 | 96.93 | 1.729 |
| | 250 | 1.909 | 86.98 | 1.660 |
| | 275 | 3.618 | 85.73 | 3.102 |
| | 290 | 4.443 | 19.74 | 0.877 |
| 19.67 | 200 | 0.493 | 73.86 | 0.364 |
| | 225 | 1.031 | 96.81 | 0.998 |
| | 250 | 1.289 | 83.57 | 1.077 |
| | 275 | 2.751 | 83.03 | 2.284 |
| | 290 | 3.214 | 10.05 | 0.323 |

**Table B2** The catalytic activity of ethylene epoxidation over Ag-loaded $\alpha$-$Al_2O_3$ catalysts prepared with various Ag loadings at $O_2$:$C_2H_4$ ratio of 1:1, space velocity of 6,000 $h^{-1}$, and different reaction temperatures

| Ag loading (wt.%) | Temperature (°C) | $C_2H_4$ conversion (%) | EO selectivity (%) | EO yield (%) |
|---|---|---|---|---|
| 9.71 | 200 | 0.650 | 99.25 | 0.645 |
| | 225 | 1.153 | 89.42 | 1.031 |
| | 250 | 1.987 | 88.55 | 1.759 |
| | 275 | 2.482 | 66.82 | 1.659 |
| | 290 | 3.987 | 22.42 | 0.894 |
| 13.22 | 200 | 0.781 | 99.42 | 0.776 |
| | 225 | 1.506 | 83.27 | 1.254 |
| | 250 | 2.224 | 58.97 | 1.312 |
| | 275 | 2.671 | 30.94 | 0.826 |
| | 290 | 4.185 | 24.38 | 1.020 |
| 14.86 | 200 | 1.463 | 98.88 | 1.447 |
| | 225 | 1.697 | 98.09 | 1.665 |
| | 250 | 2.648 | 87.47 | 2.320 |
| | 275 | 3.632 | 77.39 | 2.811 |
| | 290 | 4.598 | 38.45 | 1.768 |

**Table B3** The catalytic activity of ethylene epoxidation over Ag-loaded $TiO_2$ P25 catalyst at $O_2$:$C_2H_4$ ratio of 1:1, space velocity of 6,000 $h^{-1}$, and different reaction temperatures

| Ag loading (wt.%) | Temperature (°C) | $C_2H_4$ conversion (%) | EO selectivity (%) | EO yield (%) |
|---|---|---|---|---|
| 14.52 | 225 | 0.424 | 94.17 | 0.399 |
| | 250 | 2.992 | 80.29 | 2.402 |
| | 275 | 3.592 | 56.31 | 2.020 |
| | 290 | 4.089 | 28.57 | 1.168 |

**Table B4** The catalytic activity of ethylene epoxidation over Ag-loaded $TiO_2$ (sol-gel) catalyst at $O_2$:$C_2H_4$ ratio of 1:1, space velocity of 6,000 $h^{-1}$, and different reaction temperatures

| Ag loading (wt.%) | Temperature (°C) | $C_2H_4$ conversion (%) | EO selectivity (%) | EO yield (%) |
|---|---|---|---|---|
| 14.67 | 225 | 0.987 | 76.77 | 0.758 |
| | 250 | 1.273 | 72.93 | 0.928 |
| | 275 | 2.532 | 69.70 | 1.765 |
| | 290 | 3.012 | 10.23 | 0.308 |

**Table B5** The catalytic activity of ethylene epoxidation over Ag-loaded $SrTiO_3$ (sol-gel) catalyst at $O_2$:$C_2H_4$ ratio of 1:1, space velocity of 6,000 $h^{-1}$, and different reaction temperatures

| Ag loading (wt.%) | Temperature (°C) | $C_2H_4$ conversion (%) | EO selectivity (%) | EO yield (%) |
|---|---|---|---|---|
| 14.85 | 225 | 0.819 | 99.77 | 0.817 |
| | 250 | 1.944 | 99.18 | 1.928 |
| | 275 | 3.534 | 98.50 | 3.481 |
| | 290 | 3.784 | 54.49 | 2.062 |
| | 300 | 4.089 | 24.12 | 0.986 |
| | 310 | 4.517 | 12.10 | 0.547 |
| | 320 | 4.983 | 0 | 0 |

**Table B6** The catalytic activity of ethylene epoxidation over Ag-loaded nano $SrTiO_3$ catalyst at $O_2$:$C_2H_4$ ratio of 1:1, space velocity of 6,000 $h^{-1}$, and different reaction temperatures

| Ag loading (wt.%) | Temperature (°C) | $C_2H_4$ conversion (%) | EO selectivity (%) | EO yield (%) |
|---|---|---|---|---|
| 14.61 | 225 | 1.396 | 72.68 | 1.014 |
| | 250 | 3.302 | 61.68 | 2.040 |
| | 275 | 4.021 | 48.56 | 1.950 |
| | 290 | 4.429 | 35.89 | 1.590 |
| | 300 | 4.582 | 12.13 | 0.556 |
| | 310 | 4.784 | 0 | 0 |

**Table B7** The catalytic activity of ethylene epoxidation over Ag-loaded $SiO_2$ 90 catalysts prepared with various Ag loadings at $O_2$:$C_2H_4$ ratio of 1:1, space velocity of 6,000 $h^{-1}$, and different reaction temperatures

| Ag loading (wt.%) | Temperature (°C) | $C_2H_4$ conversion (%) | EO selectivity (%) | EO yield (%) |
|---|---|---|---|---|
| 9.56 | 225 | 1.178 | 79.15 | 0.932 |
| | 250 | 1.440 | 81.87 | 1.179 |
| | 275 | 1.814 | 87.23 | 1.582 |
| | 290 | 2.874 | 21.24 | 0.610 |
| | 300 | 3.258 | 2.23 | 0.073 |
| 14.71 | 225 | 1.845 | 84.28 | 1.555 |
| | 250 | 3.616 | 82.06 | 2.967 |
| | 275 | 4.401 | 86.39 | 3.800 |
| | 290 | 4.984 | 17.28 | 0.861 |
| 19.64 | 225 | 0.671 | 83.18 | 0.558 |
| | 250 | 1.212 | 80.16 | 0.972 |
| | 275 | 2.867 | 82.56 | 2.370 |
| | 290 | 4.848 | 13.12 | 0.636 |

**Table B8** The catalytic activity of ethylene epoxidation over Ag-loaded $SiO_2$ 380 catalyst at $O_2$:$C_2H_4$ ratio of 1:1, space velocity of 6,000 $h^{-1}$, and different reaction temperatures

| Ag loading (wt.%) | Temperature (°C) | $C_2H_4$ conversion (%) | EO selectivity (%) | EO yield (%) |
|---|---|---|---|---|
| 9.44 | 225 | 1.517 | 71.99 | 1.092 |
| | 250 | 1.901 | 81.90 | 1.557 |
| | 275 | 2.486 | 78.51 | 1.952 |
| | 290 | 3.254 | 12.24 | 0.398 |

**Table B9** The catalytic activity of ethylene epoxidation over Ag-loaded MOX 90 catalysts prepared with various Ag loadings at $O_2$:$C_2H_4$ ratio of 1:1, space velocity of 6,000 $h^{-1}$, and different reaction temperatures

| Ag loading (wt.%) | Temperature (°C) | $C_2H_4$ conversion (%) | EO selectivity (%) | EO yield (%) |
|---|---|---|---|---|
| 9.68 | 225 | 2.061 | 74.62 | 1.538 |
| | 250 | 3.177 | 86.03 | 2.730 |
| | 275 | 4.084 | 53.35 | 2.180 |
| | 290 | 5.231 | 2.55 | 0.133 |
| 14.66 | 225 | 0.849 | 79.79 | 0.677 |
| | 250 | 2.867 | 79.00 | 2.265 |
| | 275 | 4.087 | 78.25 | 3.198 |
| | 290 | 4.872 | 10.12 | 0.493 |

**Table B10** The catalytic activity of ethylene epoxidation over Ag-loaded MOX 380 catalyst at $O_2$:$C_2H_4$ ratio of 1:1, space velocity of 6,000 $h^{-1}$, and different reaction temperatures

| Ag loading (wt.%) | Temperature (°C) | $C_2H_4$ conversion (%) | EO selectivity (%) | EO yield (%) |
|---|---|---|---|---|
| 14.53 | 225 | 1.685 | 78.34 | 1.320 |
| | 250 | 2.584 | 81.04 | 2.094 |
| | 275 | 3.268 | 72.23 | 2.361 |
| | 290 | 3.556 | 9.48 | 0.337 |

# CURRICULUM VITAE

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2. Chongterdtoonskul, A., Schwank, J. W., and Chavadej, S. (2012). Ethylene epoxidation activity over Ag-based catalysts on different nanocrystalline perovskite titanate supports. Catalysis Letters, 142, 991-1002.
3. Chongterdtoonskul, A., Schwank, J. W., and Chavadej, S. (2012). Comparative study on influence of second metals on Ag-loaded mesoporous $SrTiO_3$ catalysts for ethylene oxide evolution. (Manuscript submitted to Journal of Molecular Catalysis A: Chemical)
4. Chongterdtoonskul, A., Schwank, J. W., and Chavadej, S. (2012). Effect of diluent gas on ethylene epoxidation activity over various Ag-based catalysts on selective oxide supports. (Manuscript submitted to Catalysis Communications)

**Presentations:**

1. Chongterdtoonskul, A., Imai, K., and Pattaraprakorn, W. (2008. April 21st), Degradation of Plastic Wastes to Liquid Fuel, The 1st Thammasat University International Conference on Chemical, Environment and Energy Engineering (TU-ChEEE), Grand Mercure Fortune, Bangkok, Thailand.
2. Chongterdtoonskul, A., Chavadej, S., Sreethawong, T., and Schwank, J. W. (2011, June 5th -10th), Effect of Support on Ethylene Epoxidation over Ag Catalysts. Paper presented at 22nd North American Catalysis Society Meeting (NACS), The Detroit Mariott at Renaissance Center, Detroit, U.S.A.
3. Chongterdtoonskul, A., Chavadej, S., and Schwank, J. W. (2012, February 21st-24th), Ethylene Epoxidation over Ag-Based Catalysts on Different Supports. Paper presented at The 14th Asia Pacific Confederation of Chemical Engineering (APCChE), Suntec Singapore International Convention & Exhibition Center, Singapore.
4. Chongterdtoonskul, A., Chavadej, S., and Schwank, J. W. (2012, April 6th-8th), Effects of Supports on Ethylene Epoxidation Activity over Ag-Based Catalysts. Paper presented at The RGJ-Ph.D. Congress XIII, Pattaya, Chonburi, Thailand.