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APPENDICES

Appendix A XPS Analysis of Fe-Ce-MCM-48

The XPS spectra of bimetallic MCM-48 shown in Fig.A1-A3 gave the composition of products. No Fe and Ce was observed by using XPS since it is a surface technique that probes a few atomic layer of solid and the trace amount of incorporated metal was introduced into MCM-48.

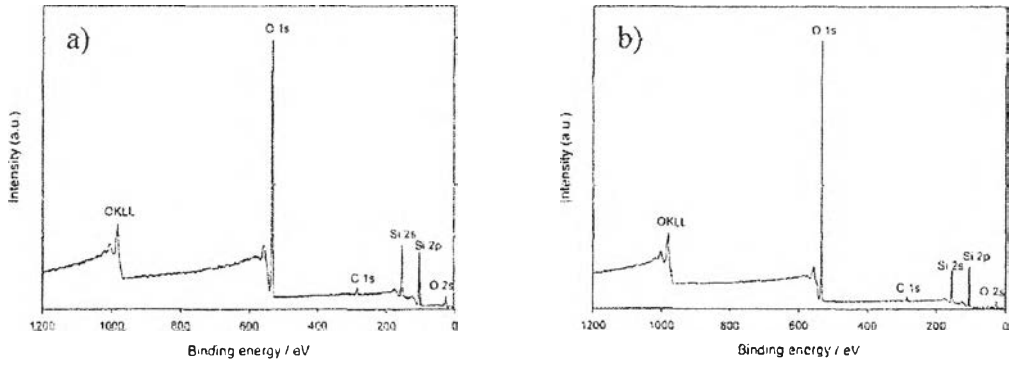

Figure A1 Survey XPS spectra of bimetallic MCM-48 : a) 0.01Fe0.01Ce-MCM-48 ; b) 0.01Fe0.03Ce-MCM-48.

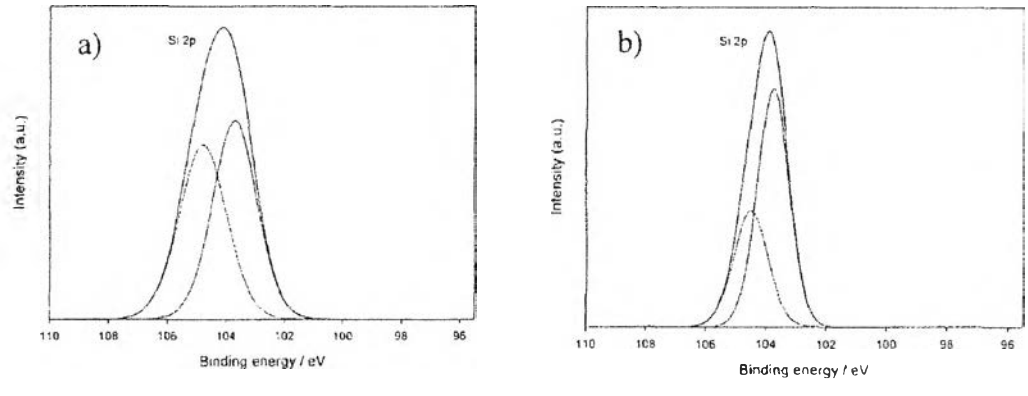

Figure A2 Si 2p XPS spectra of bimetallic MCM-48 : a) 0.01Fe0.01Ce-MCM-48 ; b) 0.01Fe0.03Ce-MCM-48.

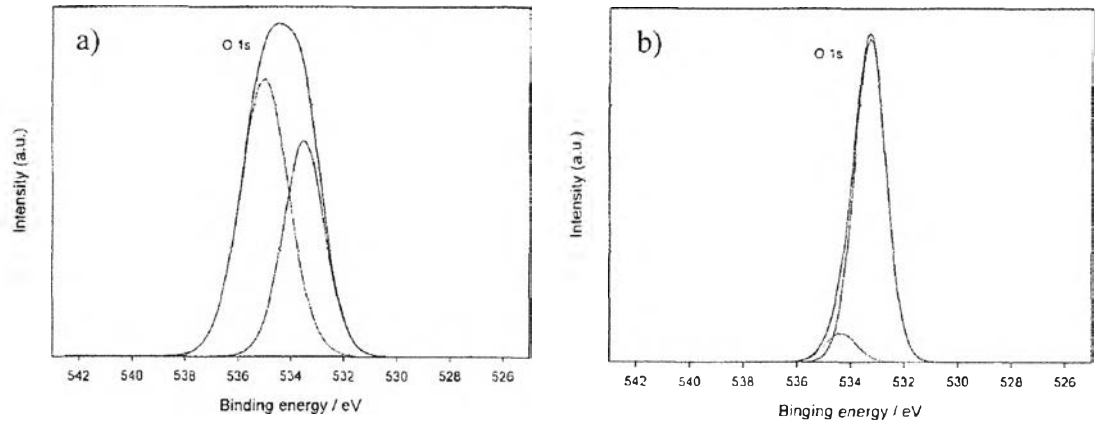

Figure A3 O 1s XPS spectra of bimetallic MCM-48 : a) 0.01Fe0.01Ce-MCM-48 ; b) 0.01Fe0.03Ce-MCM-48.

Table A1 XPS analysis of 0.01Fe0.01Ce-MCM-48 and 0.01Fe0.03Ce-MCM-48

Catalyst	Peak	Binding energy (eV)	% Atomic conc.
0.01Fe0.01Ce-MCM-48	Si 2p	104.2	27.14
	O 1s	535.2	66.62
	C 1s	285.2	6.24
0.01Fe0.03Ce-MCM-48	Si 2p	103.2	26.89
	O 1s	533.2	69.49
	C 1s	284.2	3.62

Appendix B The Band Gap Energy Calculation

The following calculation method was used to determine the band gap energy (E_g) from UV-vis spectra. The wavelength was obtained from the linear portion near the peak of the spectrum, as shown in Fig. B1.

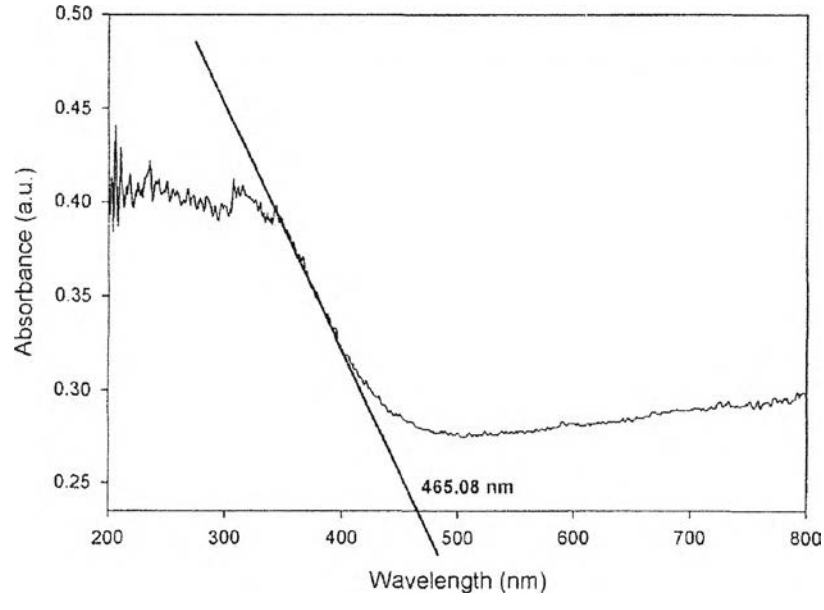

Figure B1 DR UV-vis spectra of 0.01Ce-MCM-48.

The band gap can be calculated from $E_g = hc/\lambda$, where E_g is the band gap energy, h is Planck's constant (6.626 x 10^{-34} J·s), c is the speed of light (2.997 x 10^8 m/s), and λ is the wavelength. From Fig.B1, the wavelength obtained was equal to 465.08 nm.

$$E_g = \frac{hc}{\lambda} = \frac{(6.626\times10^{-34} J\cdot s)(2.997\times10^{8} m/s)}{(465.08\times10^{-9} m)}$$

$$E_g = 4.2698\times10^{-19} J = 2.665 eV$$

Where J = 6.242 x 10^{18} eV

That means, the band gap energy of 0.01Ce-MCM-48 is 2.665 eV.

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Publications:

1. Maneesuwan, H.; Longloilert, R.; Chaisuwan, T.; and Wongkasemjit, S. (2013) Synthesis and characterization of Fe-Ce-MCM-48 from silatrane precursor via sol-gel process. Materials Letters, 94, 65-68.
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5. Maneesuwan, H.; Chaisuwan, T.; and Wongkasemjit, S. (2014) Catalysis of bimetallic Fe-Ti-MCM-48 for phenol hydroxylation and its hydrothermal stability. Microporous and Mesoporous Materials, To be submitted.

Presentations:

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