NH_3-DeNO$_x$ Activity of Composite Catalysts [Meso-Ce$_x$Zr$_{1-x}$O$_2$ + Micro-Fe-Beta]

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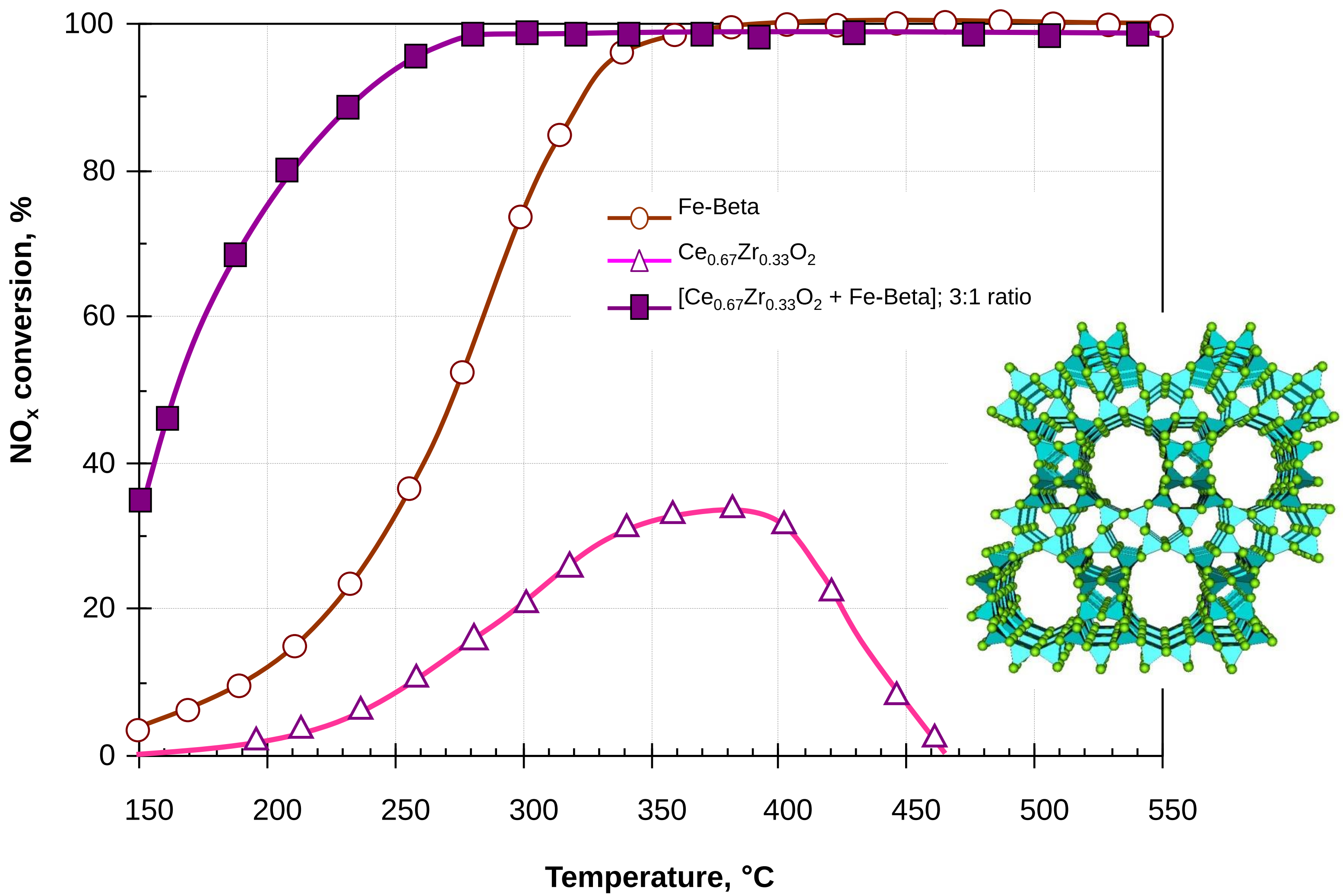
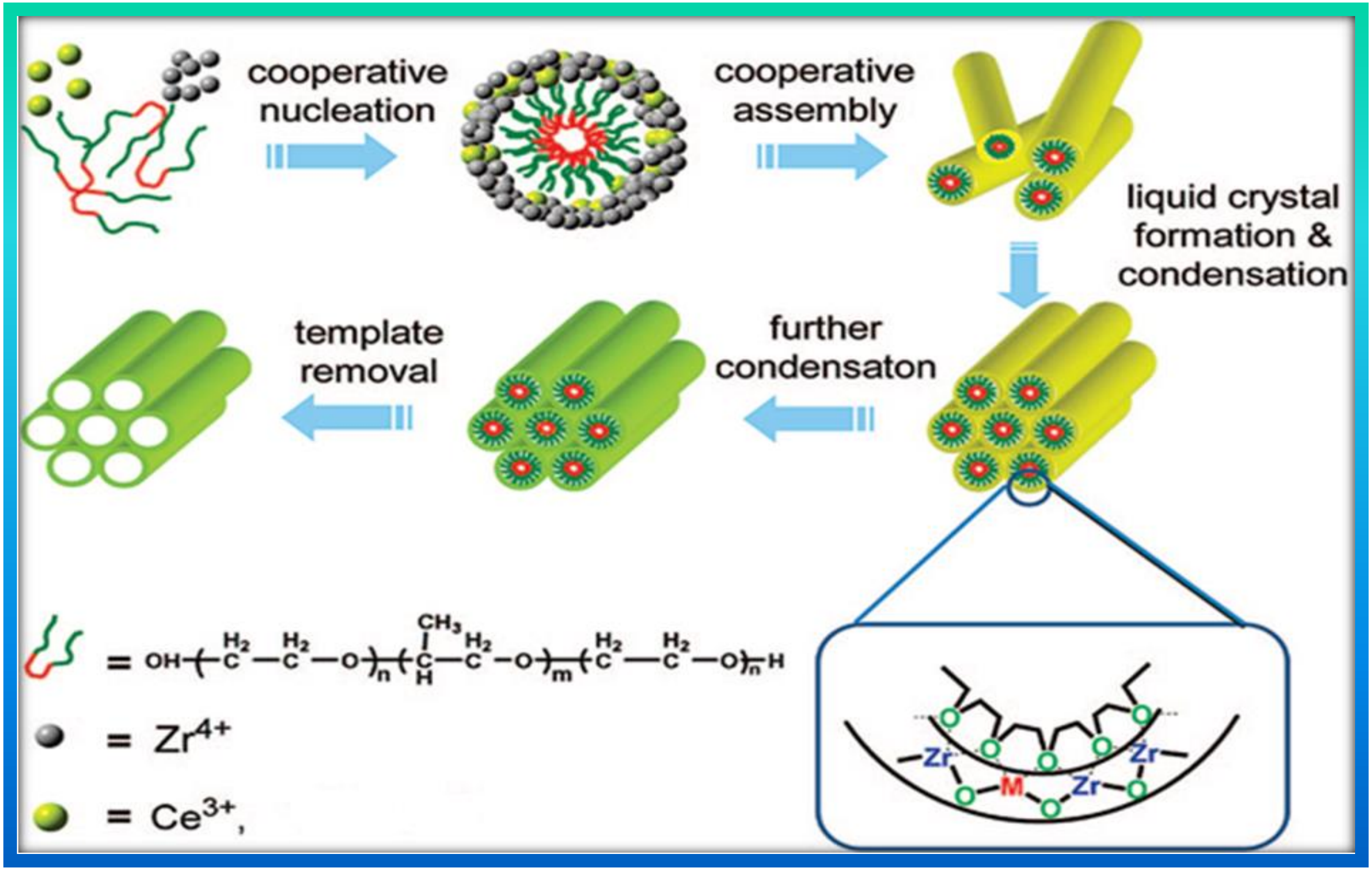


Comparison of $DeNO_x$ performance of individual components ($Ce_{0.67}Zr_{0.33}O_2$ and Fe-Beta), and composite catalyst [$Ce_{0.67}Zr_{0.33}O_2$ + Fe-Beta].

Stakheev et al., Top. Catal., 56 (2013) 427.

Evaporation Induced Self-Assembly (EISA) Method

(Schematic representation of the Synthesis Procedure of Ordered Mesoporous $Ce_{1-x}Zr_xO_2$ Solid Solution)

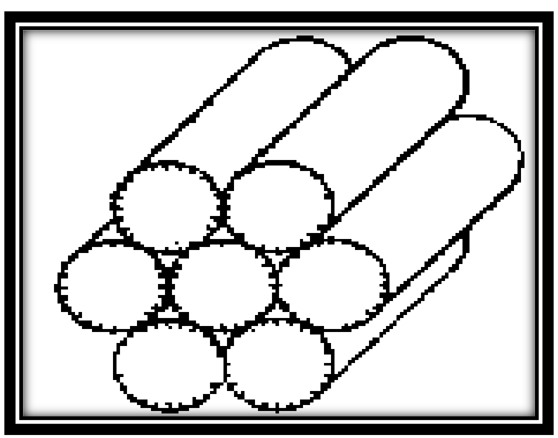


Yuan et al., *J. Phys. Chem. C*, 2009, 113, 4117–4124.

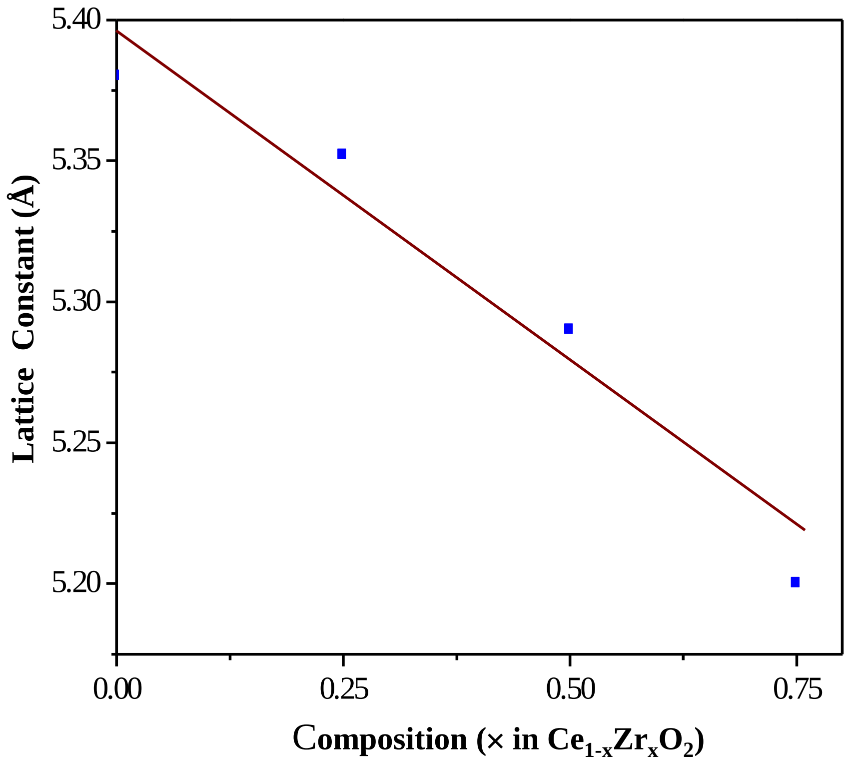
Structural and textural properties of mesostructured CeO_2 and $Ce_{1-x}Zr_xO_2$

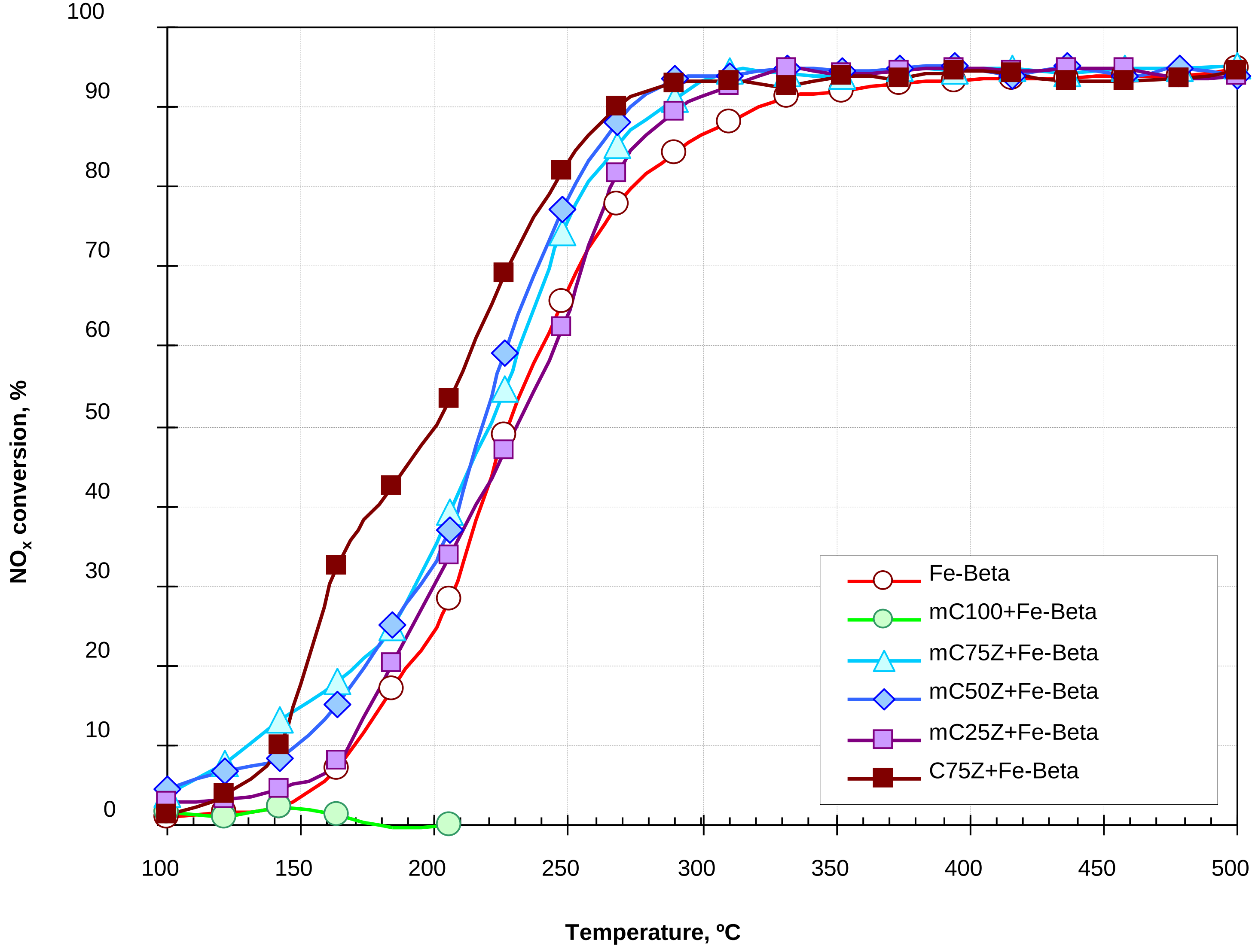
S. Khan, M.Tech. Dissertation, IIT-Madras, 2011.

Materials	a_0 (Å)	d_{100} (nm)	t (nm)	S_{BET} ($m^2\ g^{-1}$)	D (nm)	V_P ($cm^3\ g^{-1}$)
CeO_2	5.38	7.94	7.2	100.1	3.1	0.29
$Ce_{0.75}Zr_{0.25}O_2$	5.36	10.96	7.5	76.7	4.1	0.09
$Ce_{0.50}Zr_{0.50}O_2$	5.29	9.09	7.6	70.6	3.7	0.08
$Ce_{0.25}Zr_{0.75}O_2$	5.19	5.39	7.8	58.2	3.6	0.08

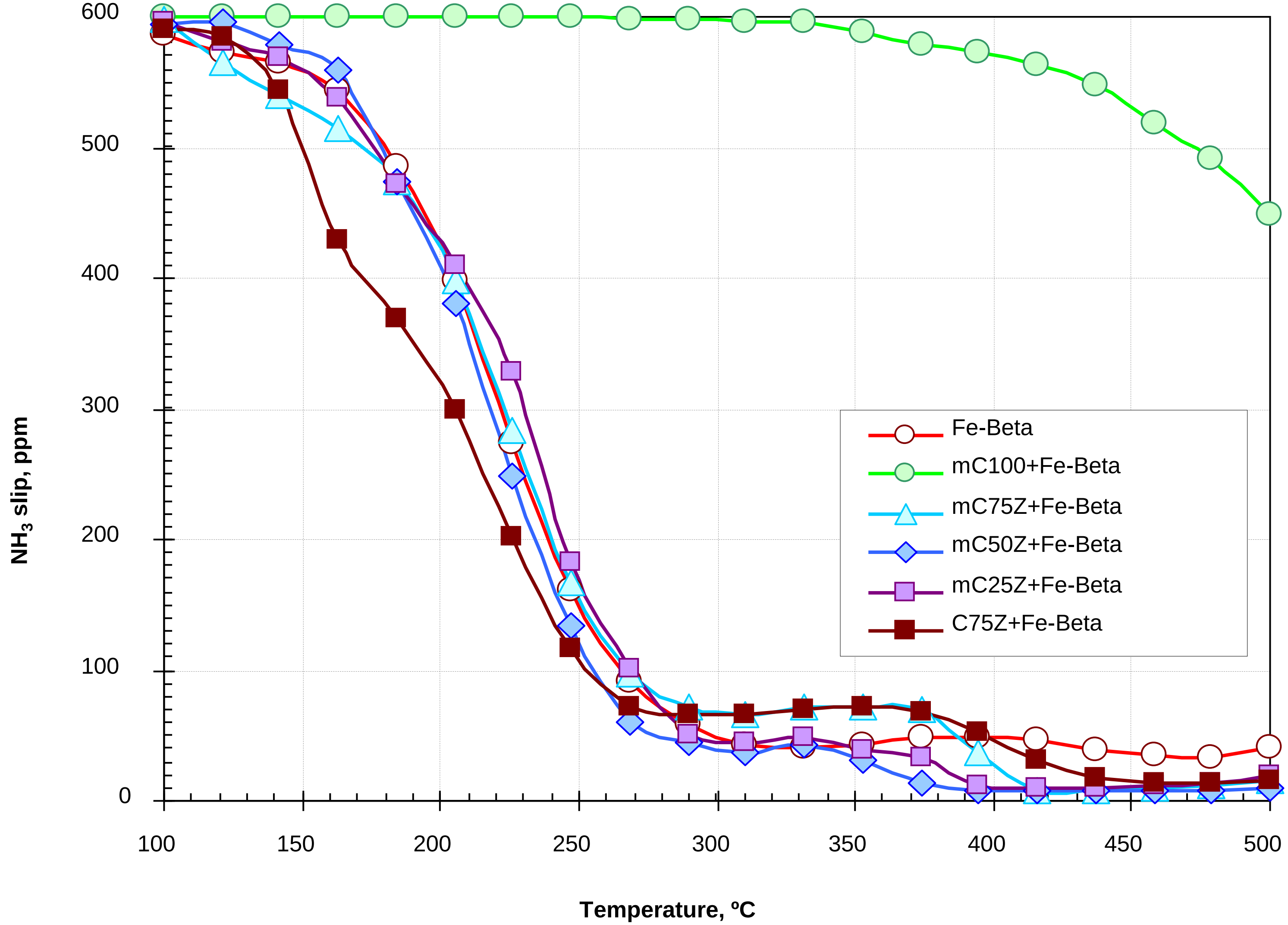


Lattice constant of mesoporous $Ce_{1-x}Zr_xO_2$ as a function of Zr content '×'.

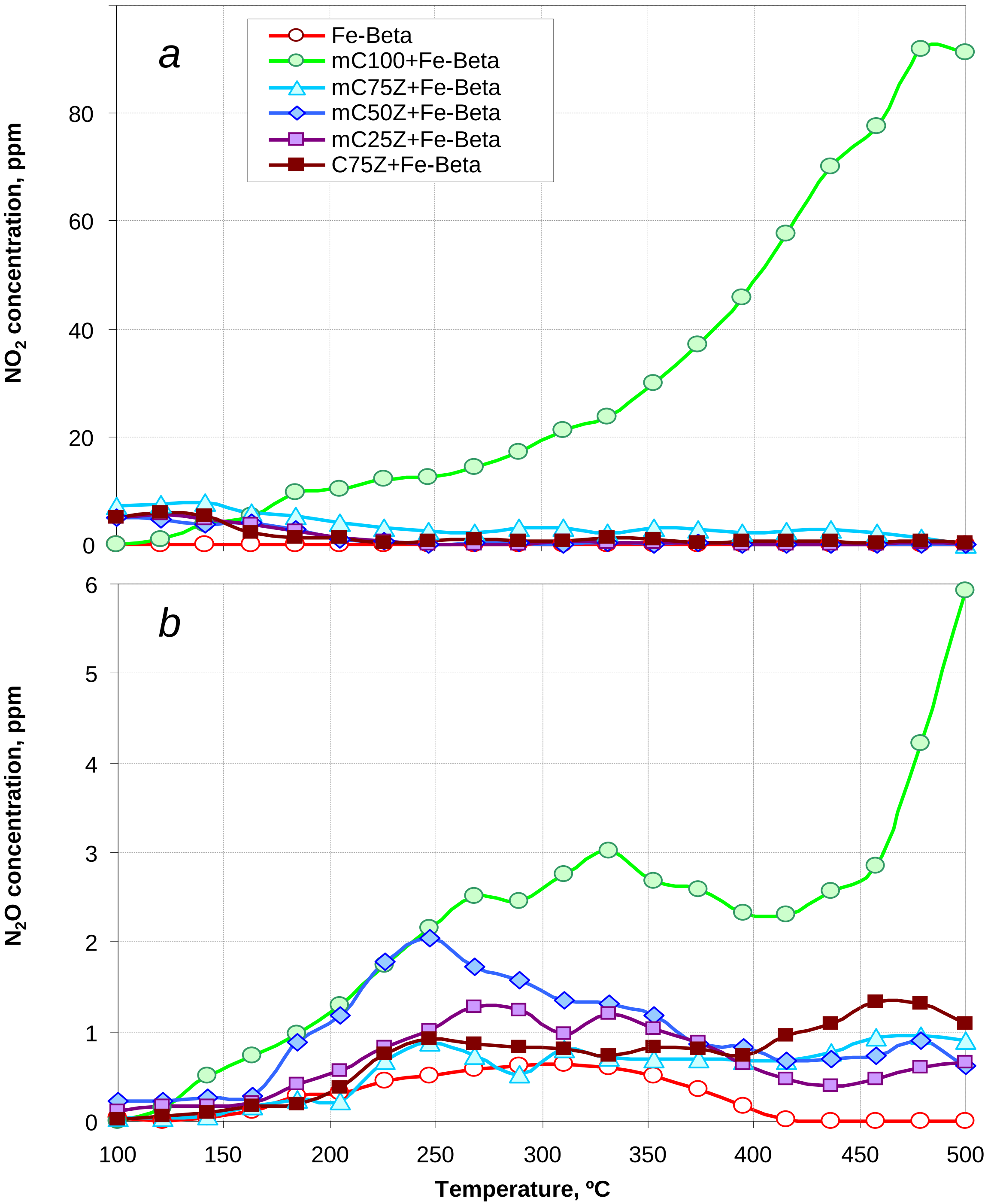




NH_3-DeNO$_x$ performance of Fe-Beta zeolite and the composite [$Ce_xZr_{(1-x)}O_2$ + Fe-Beta].
NO_x conversion. Overall flow rate: 300 ml/min. Catalyst load: 0.160 g (Fe-Beta load: 0.04 g).



NH_3-DeNO$_x$ performance of Fe-Beta zeolite and the composite [$Ce_xZr_{(1-x)}O_2$ + Fe-Beta]. Outlet NH_3 concentration. Overall flow rate: 300 ml/min. Catalyst load: 0.160 g (Fe-Beta load: 0.04 g).



Reaction product distribution for Fe-Beta and [$Ce_xZr_{(1-x)}O_2$+Fe-Beta] composite catalysts.

(a)NO_2 concentration, ppm

(b)N_2O concentration, ppm

Mesoporous Silica-based Catalysts for the Reduction of NO by CO:
Effect of Noble Metals and Catalysts Preparation Methods



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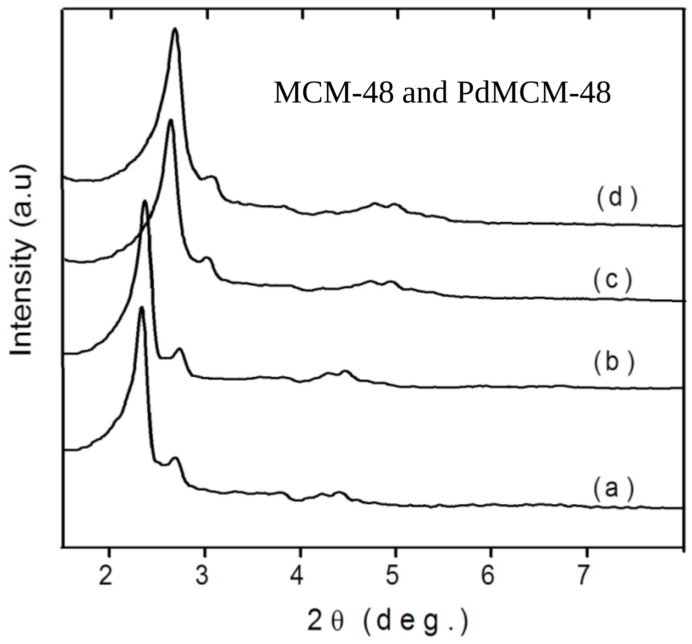
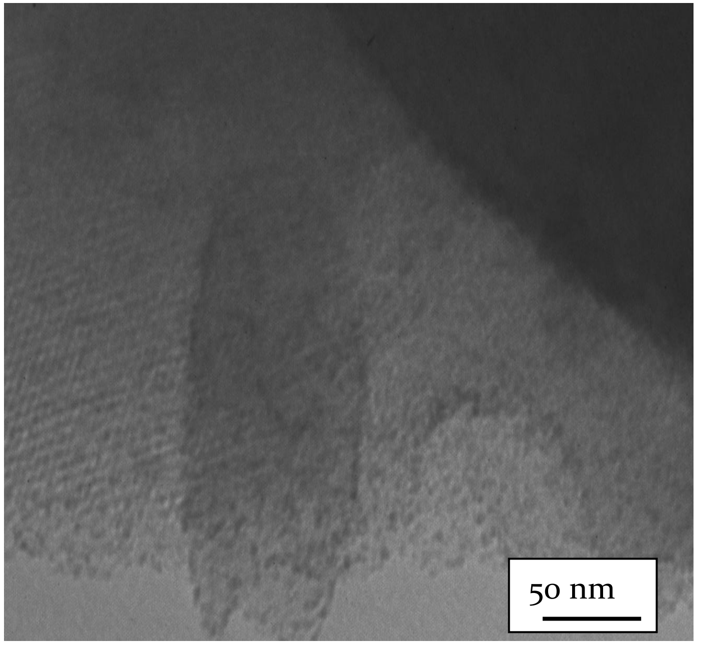
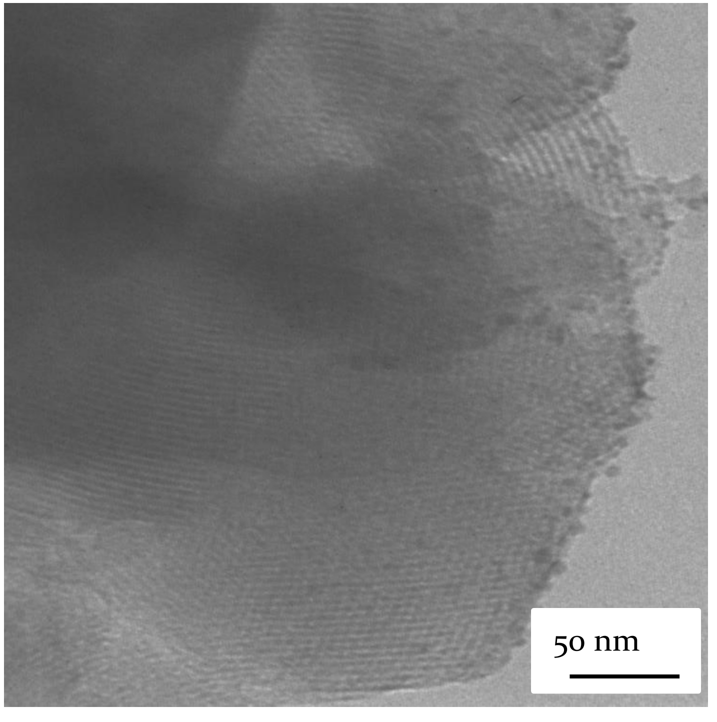
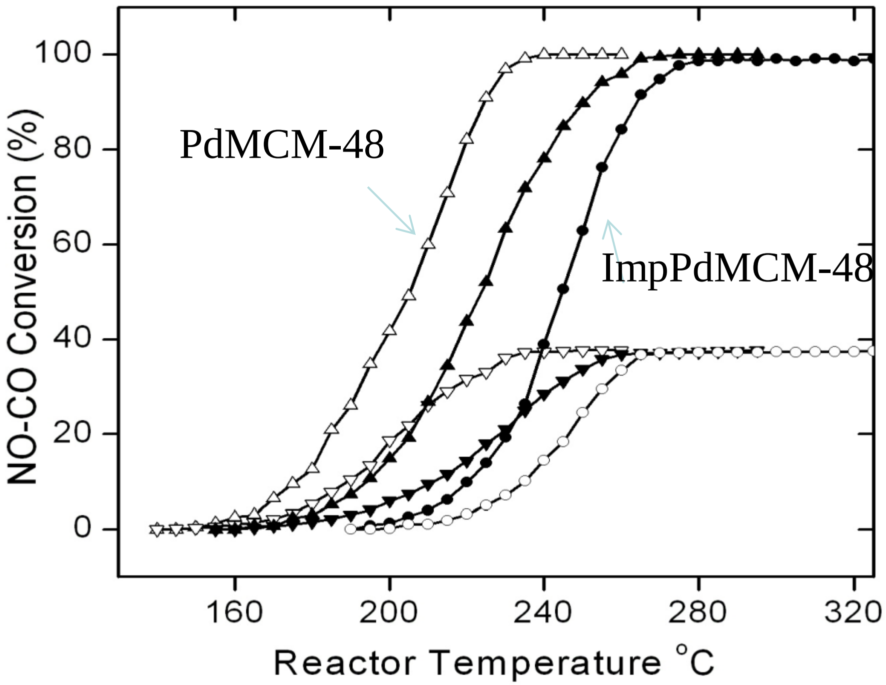






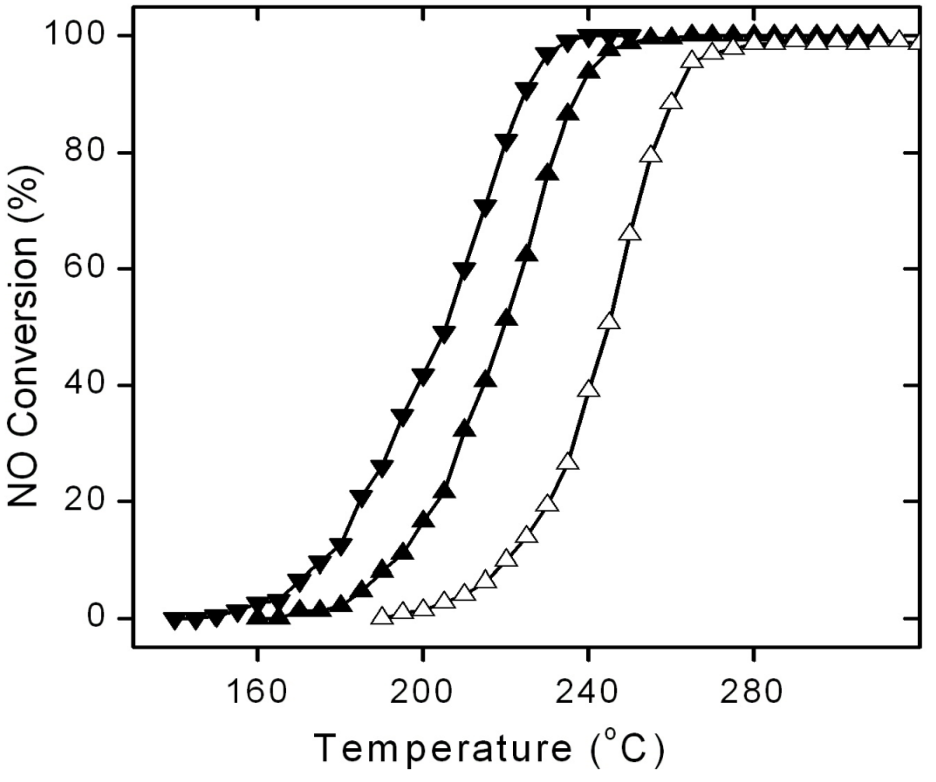
Catalyst	Surface area (m^2/g)	Metal content (%)	Metal Size (nm)
PdMCM-48	1007	3.90	2.80
PdMCM-48	986	3.85	8.30
PdMCM-48	950	3.75	15.9
RhMCM-48	1021	3.98	----
RuMCM-48	924	3.95	15.7
PtMCM-48	950	3.90	13.0
PdMCM-41	870	4.00	3.10
PdSBA-3	805	3.90	4.30



Effect of catalyst preparation method

Catalyst	Pd size (nm)	Pd content (wt %)	NO conversion 25%	NO conversion 100%
PdMCM-48	2.8	3.90	190 °C	235 °C
PdMCM-48 (DP)	8.3	3.85	210 °C	265 °C
PdMCM-48 (IMP)	15.9	3.75	235 °C	280 °C

Effect of Supports



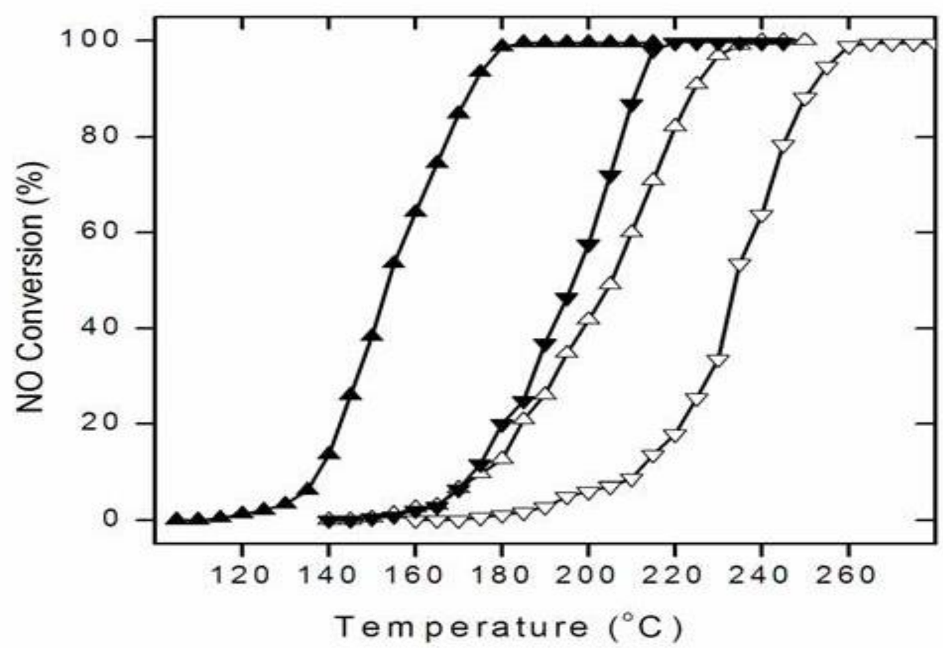
Effect of reaction temperature on the reduction of NO by CO reaction over different mesoporous supports :

[-▼-] PdMCM-48
[-▲-] PdMCM-41
[-Δ-] PdSBA-3 .

- PdMCM-48 in effective among the mesoporous supports.
- All Pd containing MFI structure shows near about same performance.

Comparisons of Noble Metal Effect on MCM-48

RhMCM-48 is active at low temp. PdMCM-48 and RuMCM-48 show better activity than PtMCM-41



Catalytic performances of different noble metal supported [-▲-] RhMCM-48, [-▼-] RuMCM-48, [-Δ-] PdMCM-48, and [-∇-] PtMCM-48 catalysts.

Catalysts	Size nm	NO conversion 25%	100%
PdMCM-48	2.8	190 °C	235 °C
RhMCM-48	1.9	145 °C	185 °C
RuMCM-48	15.7	185 °C	220 °C
PtMCM-48	13.0	225 °C	260 °C

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