# APPLICATION OF X-RAY DIFFRACTION AND SCANNING ELECTRON MICROSCOPY TECHNIQUES FOR STRUCTURE AND MORPHOLOGY ELUCIDATION OF TIN (IV) OXIDE BASED CATALYST

Imran Syakir Mohamad, Wan Azelee Wan Abu Bakar,
Abd. Rahim Yacob,
Nor Aziah Buang and Yap Chui Peng

Department of Chemistry, Faculty of Science,
Universiti Teknologi Malaysia,
81310 UTM, Skudai,
Johor Bahru, Johor.

# INTRODUCTION

Air pollution – major environmental health problem.

High air pollutants concentration – causes dangerous effects towards human being & environment

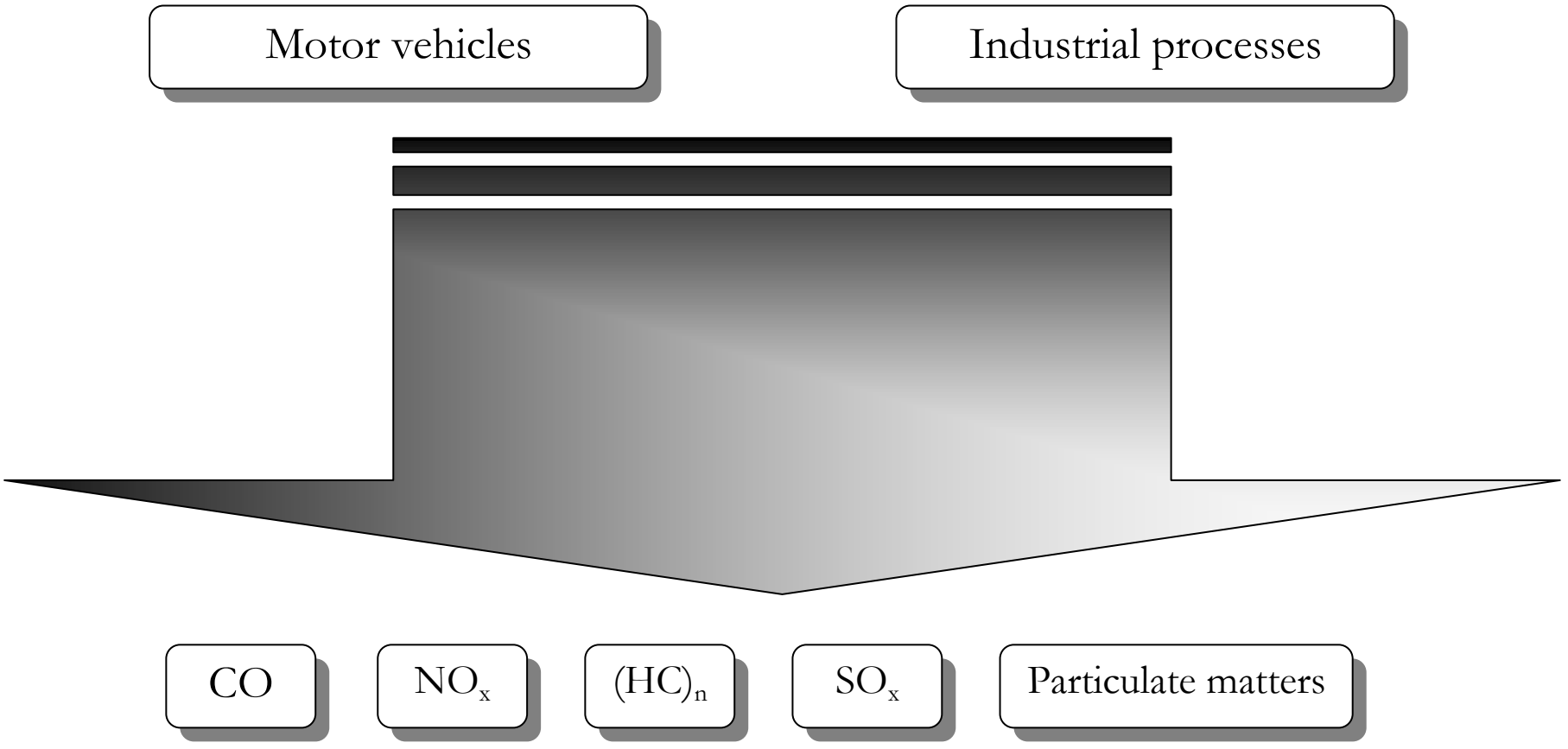
## DEFINITION OF AIR POLLUTION

World Health Organisation (WHO)

Air contains toxic substances

hazardous to man and environment.

# SOURCES OF AIR POLLUTION



**CONTROL STRATEGIES**

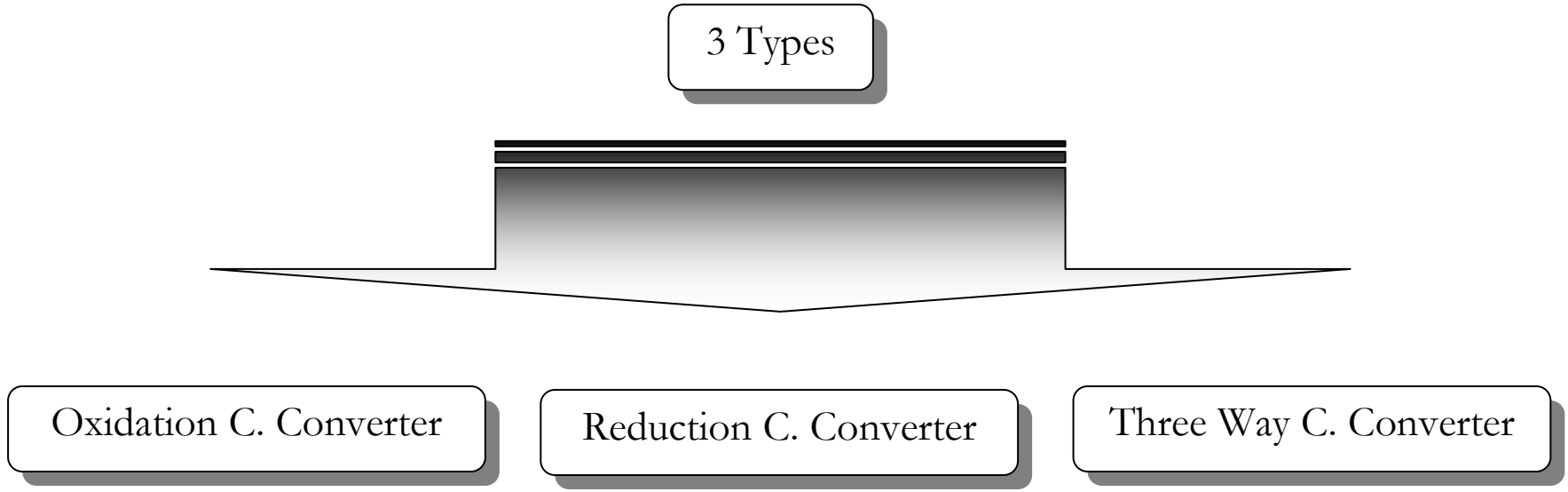
1974
Environmental
Quality Act

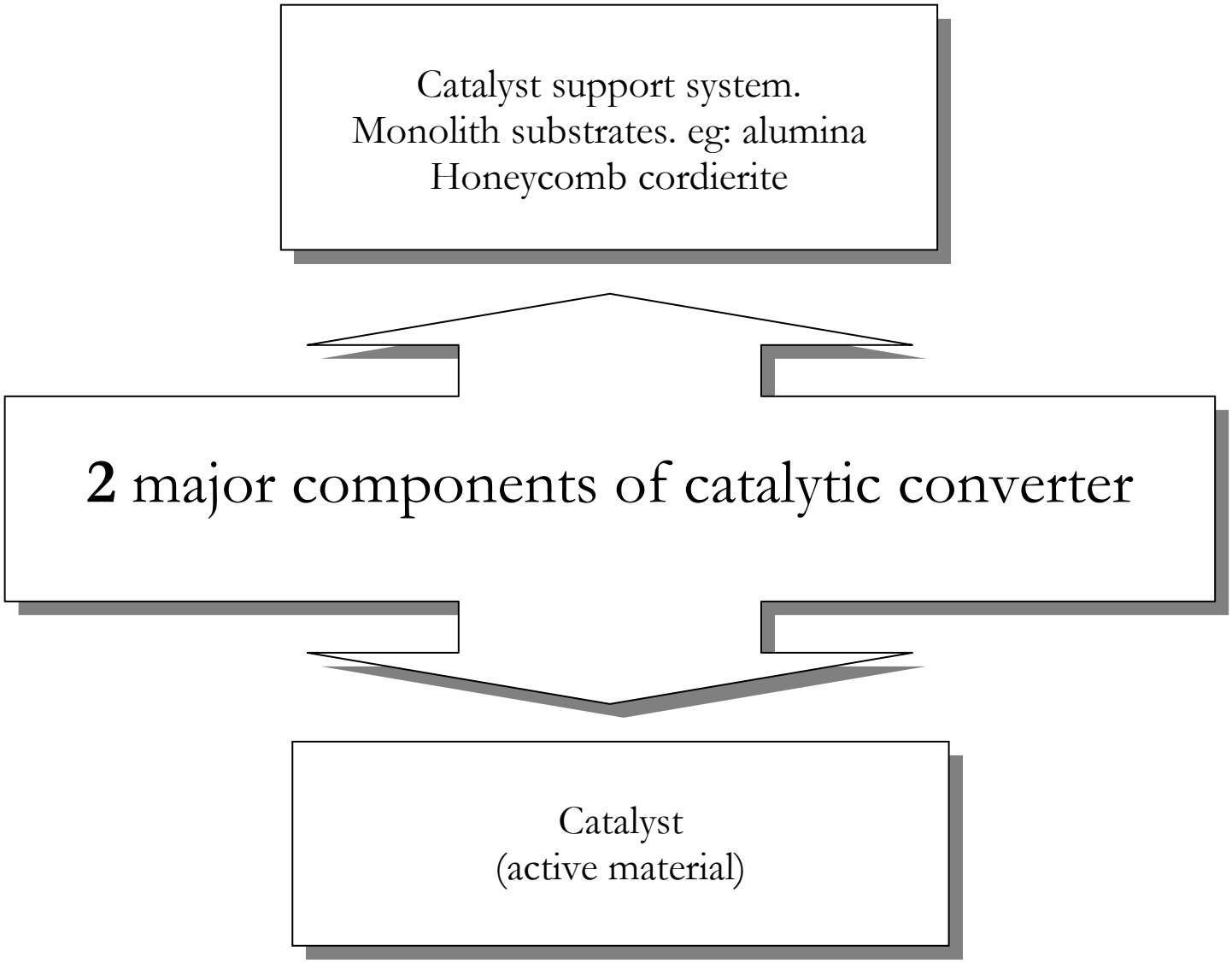
1994
Catalytic Converter has
been introduced

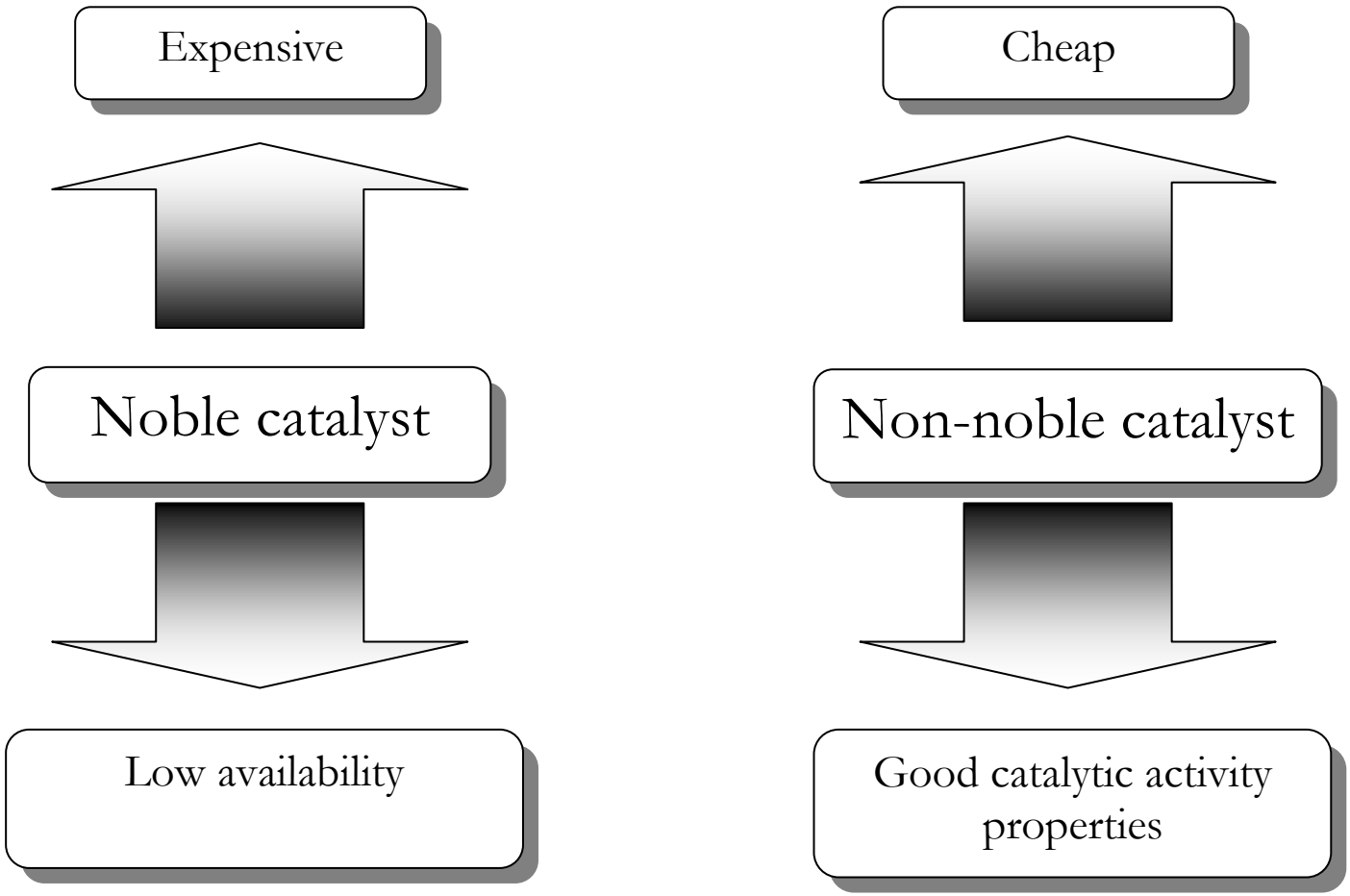
# CATALYTIC CONVERTER

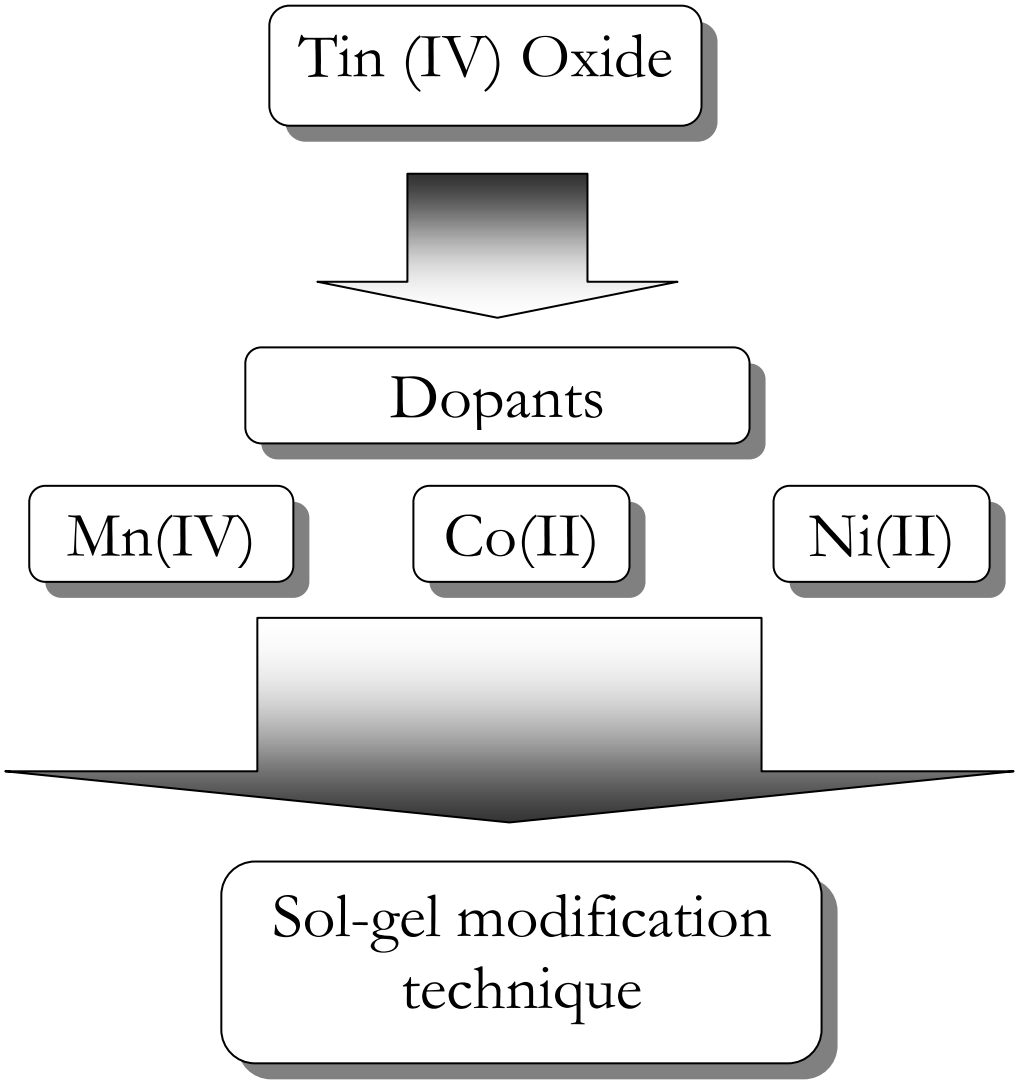
A new device to treat exhaust gases emission

which converts the toxic gases to non-toxic gases

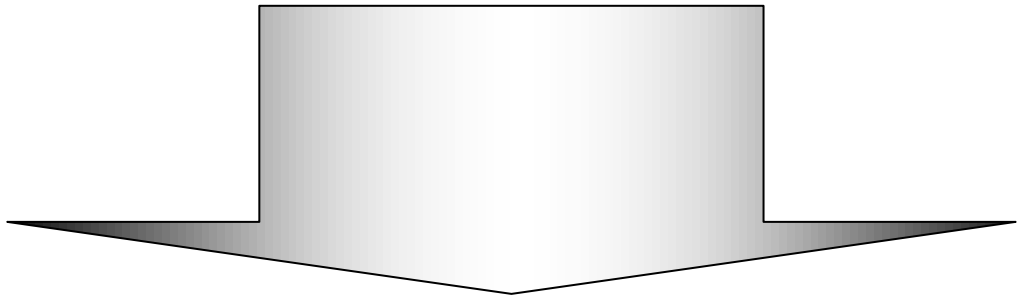



Catalyst support system.
Monolith substrates. eg: alumina
Honeycomb cordierite
2 major components of catalytic converter
Catalyst
(active material)


Expensive
Cheap
Noble catalyst
Non-noble catalyst
Low availability
Good catalytic activity properties


Tin (IV) Oxide
Dopants
Mn(IV)
Co(II)
Ni(II)
Sol-gel modification technique

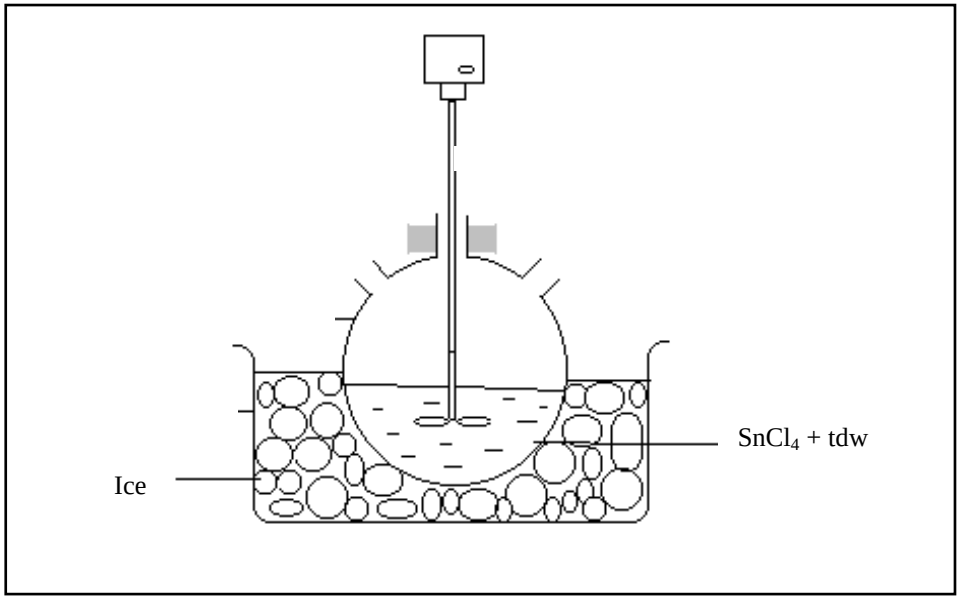
# RESEARCH OBJECTIVES

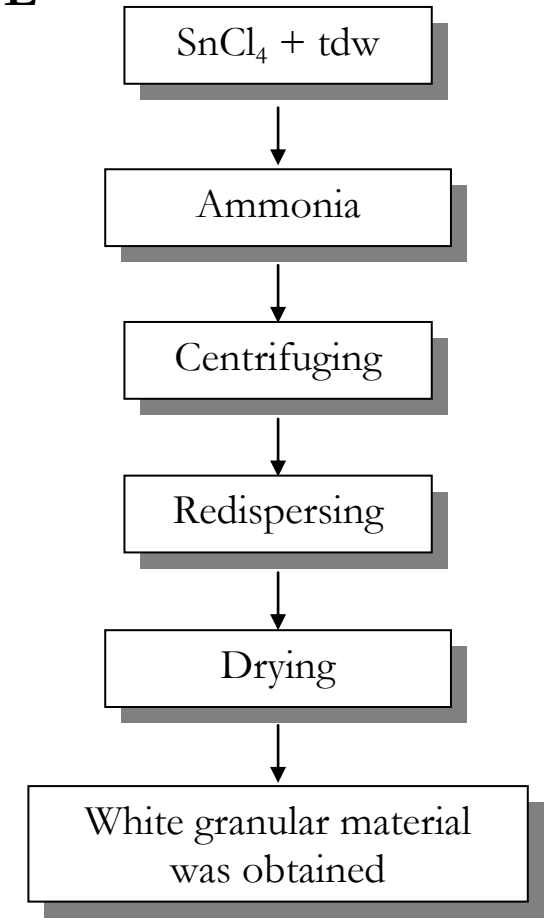


To prepare & characterize the best catalyst using various analytical techniques.

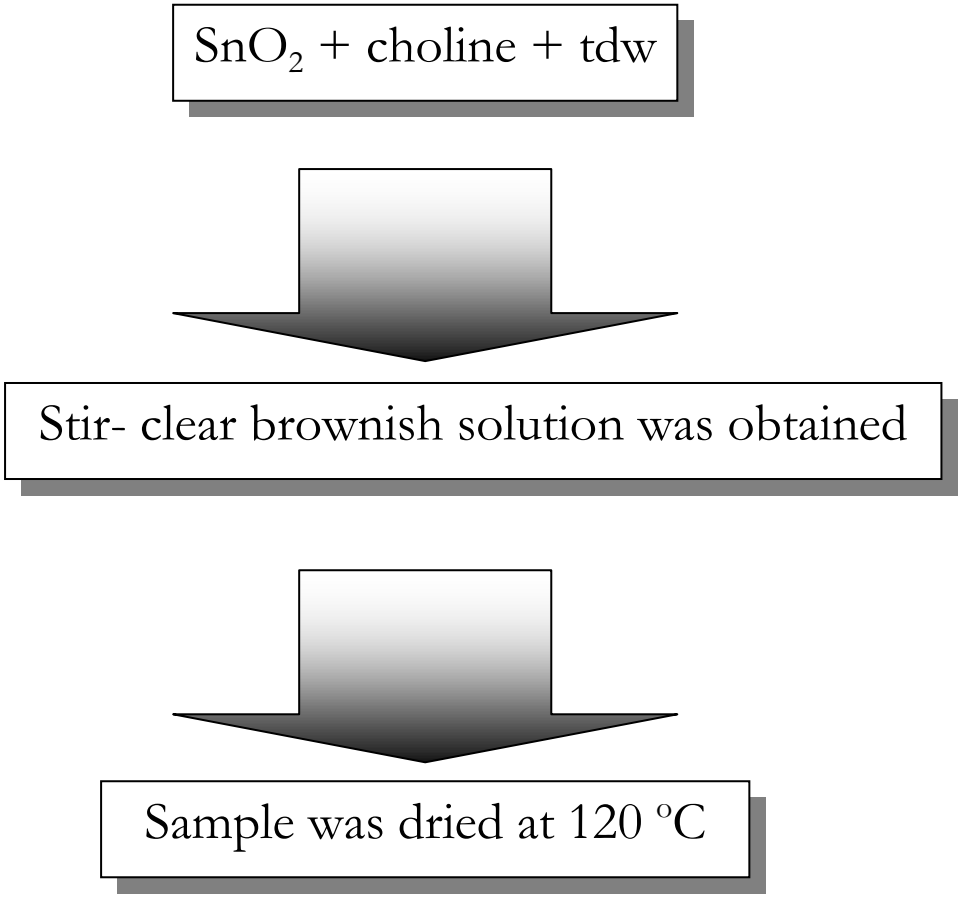
# EXPERIMENTAL

## PREPARATION OF TIN (IV) OXIDE

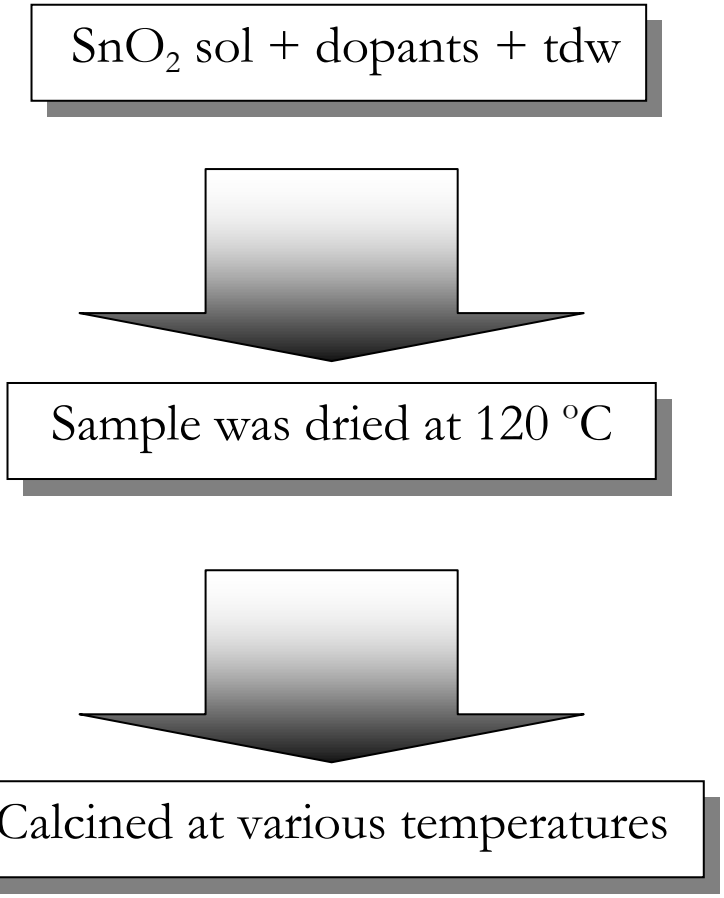


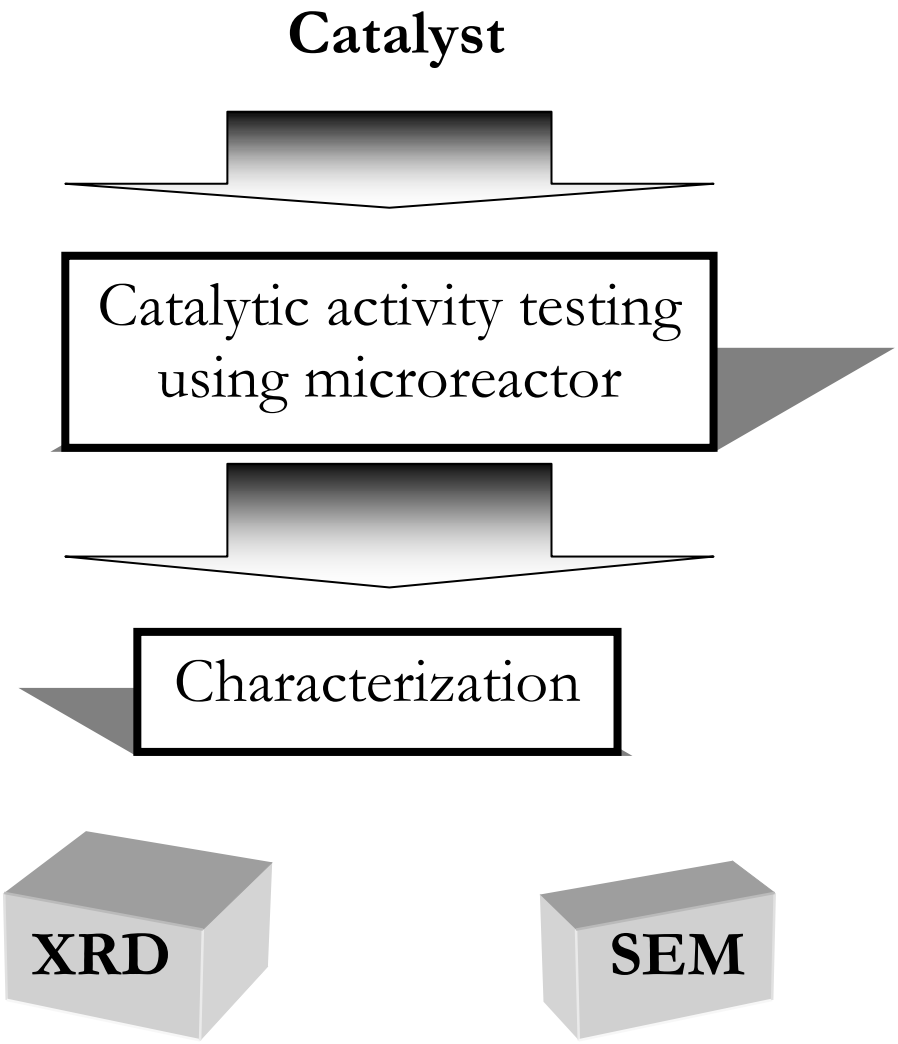



## PREPARATION OF TIN (IV) OXIDE SOL




## CATALYST PREPARATION




Catalyst
Catalytic activity testing using microreactor
Characterization
XRD
SEM

# RESULTS & DISCUSSION

## CATALYTIC ACTIVITY TESTING

| **Samples** | **$T_{100}$ [CO] (°C)** | | | |
|---|---|---|---|---|
| | **400 °C** | **600 °C** | **800 °C** | **1000 °C** |
| Co(II)-doped $SnO_2$ | 175 | 180 | 250 | 390 |
| **Ni(II)/Co(II)-doped $SnO_2$** | 220 | 150 | 260 | 390 |

$T_{100}$ [CO] (°C) : temperature of 100 % conversion of CO to $CO_2$

# X-RAY DIFFRACTION ANALYSIS

- Diffractometer D5000 Siemens Kristalloflex
- The phase changes for Ni(II)/Co(II)-doped $SnO_2$ were obtained by comparing with the 2θ value from the PDF File.
- Calcination temp.  - narrow peaks with  intensity indicates the formation of crystalline properties.
- Ni(II)/Co(II)-doped $SnO_2$ catalyst calcined at 600 °C gave the best activity with $T_{100}$ = 150 °C – observed both cobalt oxide (CoO and $Co_3O_4$) peaks. In this case, both oxidation number of cobalt oxide, $Co^{2+}$ and $Co^{3+}$ will increase the catalytic activity.

# CONCLUSION

**CATALYTIC ACTIVITY TESTING**:

Ni(II)/Co(II)-doped $SnO_2$ catalyst calcined at 600 °C gave the best activity with $T_{100}$ (CO) = 150 °C

**XRD** :

Both oxidation number of cobalt oxide (CoO and $Co_3O_4$) with cubic structure, $Co^{2+}$ and $Co^{3+}$ observed in the materials will increase the catalytic activity.

**SEM** :

Show the material with particle size within the range 17 – 50 μm with less degree of amorphous character.

# ACKNOWLEDGEMENTS

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