LUXFER
MEL TECHNOLOGIES

DATASHEET • ZIRCONIA-BASED SUPPORTS

# Zirconia-Based Materials for Catalytic Conversions

## Our capability

Luxfer MEL Technologies supplies both doped and undoped zirconium compounds (hydroxides and oxides) for a use in a wide range of catalytic applications.

Materials are solid powders, with tunable properties resulting from our proprietary manufacturing processes. These are carried out at multi-ton scale.

LMT also supplies zirconium solutions that are frequently used as binders (or indeed a Zr-source) in catalyst forming.

## Advantages

**Easy separation from reaction media**
Catalysts can be easily separated from the reaction media.

**High activity / low temperature operation**
Good interaction with supported metals, and properties can be modified by dopants.

**Structure**
They have developed (tunable) porosity and defined crystalline structure.

**Stability**
Particularly under hydrothermal (aqueous) conditions, ideal for 'green' processes.

**Reusability**
Catalysts can be used several times during reaction cycle.

**Environmentally friendly**
Zirconia-based materials do not release any halogen containing or other compounds which might corrode equipment, impact eco-system.

## Typical dopants

| Dopant | Property |
|---|---|
| Undoped | Amphoteric |
| $SO_4$, $WO_3$ | Strong Acidity |
| $SiO_2$, $Al_2O_3$ | Mild Acidity |
| MgO, $La_2O_3$ | Basic |
| $CeO_2$ | Redox |

*Other dopants can potentially be worked with, e.g. transition metal oxides, other rare-earth oxides, $SnO_2$, $Nb_2O_5$.

Multiple dopants/combinations are also manufactured on a regular basis.

## Physical properties

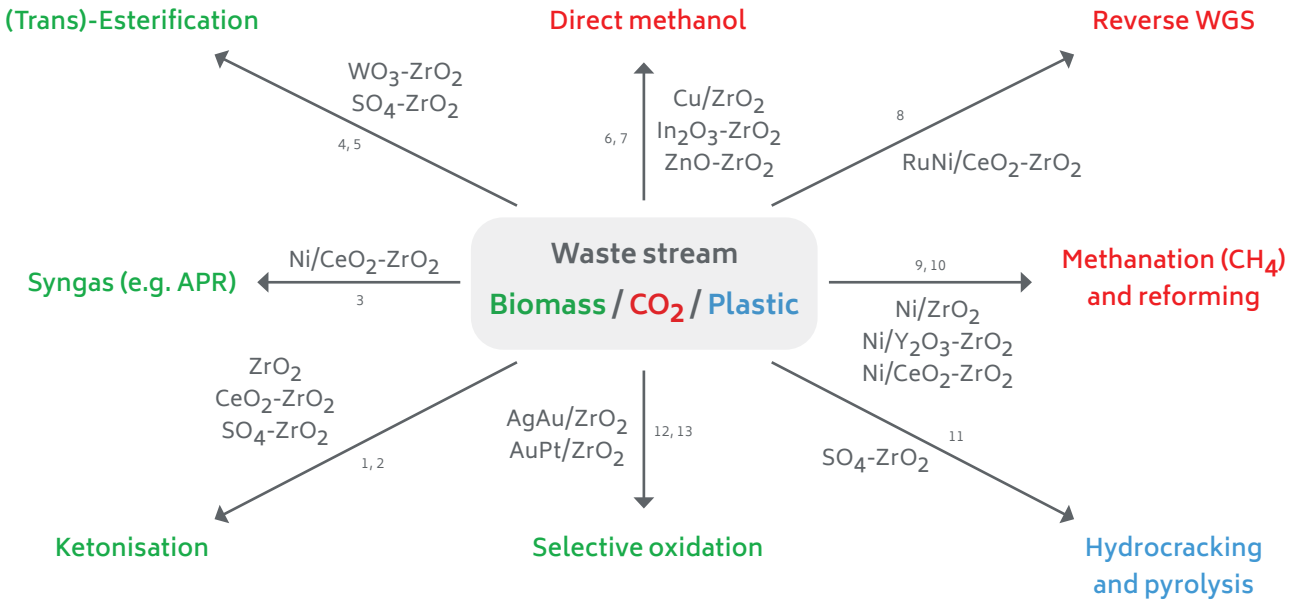
| | Synthetic Route | | | |
|---|---|---|---|---|
| | C1 | C3 | C4 | New |
| $D_{50}$ (µm) | ~1 (A)<br>~25 (B) | ~5 | ~25 (broad) | ~20 (broad) |
| Porosity | Low | Med | High | v.High |
| Surface area | Med | Med | High | v.High |
| Active sites | Med | Med | High | v.High |

*Active sites may refer to acidity for example.

## Applications

Typically has involved isomerisation of alkanes in gasoline upgrading (super-acid).

However, zirconia-based supports have attracted a lot of interest for "green" processes, for example cellulose conversion[14]. Other examples are shown below:




## References


1. Lilga, M. A. et al., *Catalysis Today*, 302, **2018**, 80-86
2. Huq, N. A., et al., *PNAS*, 118 (13), **2021**, e2023008118
3. Coronado, I., et al., *Applied Catalysis A : General*, 567, **2018**, 112-121
4. Dos Santos, V. C., et al., *Applied Catalysis B : Environmental*, 162, **2015**, 75-84
5. Sani, Y. M., et al., *Applied Catalysis A : General*, 470, **2014**, 140-161
6. Li, K, and Chen, J. G., *ACS Catalysis*, 9, **2019**, 7840-7861
7. Ye, R., et al., *Nature Communications*, 10, **2019**, Article No. 5698
8. Sache, E. L., et al., *ACS Sustainable Chemistry & Engineering*, 11, **2020**, 4614-4622
9. Frontera, P., et al., *Catalysts*, 7 (2), **2017**, 59
10. Fakeeha, A. H., et al., *Journal of Saudi Chemical Society*, 25, **2021**, 101244
11. Almustapha, M. N., et al., *Journal of Analytical and Applied Pyrolysis*, 125, **2017**, 296-303
12. Mounguengui-Diallo, M., et al., *Applied Catalysis A : General*, 551, **2018**, 88-97
13. Schade, O. R.. et al., *Advanced Synthesis & Catalysis*, 362, **2020**, 5681-5696
14. Nguyen, V. C., et al., *Molecular Catalysis*, 476, **2019**, 110518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† The information contained within is meant as a guideline only



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