JM

# Heterogeneous PGM catalysts for continuous flow processes

Johnson Matthey
Inspiring science, enhancing life

Johnson Matthey (JM) is a leader in heterogeneous catalyst supply and design. Through our essential catalyst supply and identification services, we work closely with our customers to select the optimal catalyst for each continuous process, maximising reaction efficiency. In addition to our existing product range, we offer custom catalyst design and manufacture capabilities at both large and small scale.

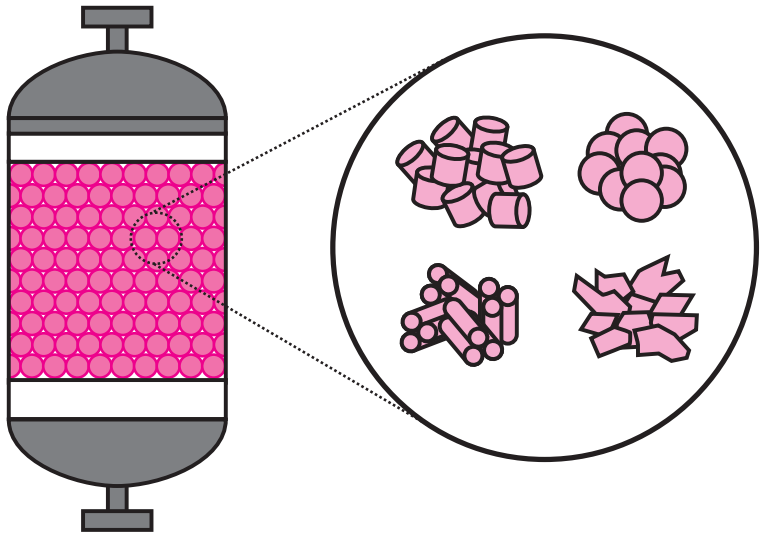

**Figure 1: Schematic of heterogeneous catalyst in fixed-bed reactor**

## Catalyst options for flow processes

### Small diameter lab reactors (up to 6.5 mm internal diameter)

Alumina spheres (0.8 - 2.5 mm diameter) and coarse powders (200-300 microns) up to 3% metal loading for Pd, Pt, Rh and Ru.

Both eggshell and uniform metal distributions are available depending on the conditions of the process.

Carbon granules are available in different size fractions, commonly 20x50 mesh (0.3 - 0.85 mm) and 60x140 mesh (0.1 - 0.25 mm), metal loadings up to 5% Pd, 4% Pt and 3% Rh

Custom catalysts are available for specific processes requirements (e.g. alpha alumina, silica, titania), with varying particle size selection and metal loadings. More complex formulations involving multiple components may also be considered on request.

**Figure 2: Carbon granules impregnated with PGM**

## Larger diameter reactors (pilot and commercial production)

Previously referenced catalyst materials are available on scale for larger commercial production units. However, larger particle size catalyst materials are often required as reactor size increases.

Carbon supports may come in the form of extrudate (cylinders) of 2 - 5 mm diameter and 3 - 10 mm length or in irregular granular form (as in the previously referenced small samples) with a size fraction of, for example, 4x8 mesh (2.4 - 4.8 mm).

Alumina can be formed into many shapes and sizes to maximise process efficacy. For example, it may be preferable to maximise surface area and minimise pressure drop in the case of more intricate materials. We currently supply 1.8 mm and 2.5 mm diameter spheres as standards. However, additional variations can be sourced.

The metal loadings which are achievable on the larger particle size supports are the same as those for the smaller laboratory materials.

**Figure 3: Alumina pellets impregnated with PGM**

## Common advantages of using flow catalysts

- High spacetime yield, making large volume chemical manufacture more economical
- Can be used for any two-phase and three-phase reaction systems
- Online recycle loop to maximise reaction yield and improve selectivity where the desired product is not thermodynamically favoured
- Less frequent shutdowns
- Lower heat and mass transfer limitations by using different configuration reactors
- Safer operating conditions from smaller reactor volumes

## FAQs

- ### What are the impacts of the catalyst selection?

  Batch processes can utilise homogeneous or heterogeneous powder catalysts. Whilst continuous processes can use powders, they more frequently use particulate (sphere, tablet etc) form catalysts. Powder and particulate catalysts have different physical properties and, often, a different active component location. It is essential that these properties are matched to the process chemistry.

- ### Can JM catalysts be used for batch and continuous processes?

  Yes, JM has extensive knowledge and experience in the development and manufacture of catalysts for batch and continuous processes. The flexibility and robustness of JM catalysts' physical properties enable the current and customised catalysts to excel in both processes.

- ### Does JM supply base metal and platinum group metal (PGM) catalysts?

  Yes, JM offers supported base metal and PGM catalysts for both batch and continuous processes.

- ### How much catalyst is required and what is the catalyst cost for batch and continuous processes?

  The quantity and cost of the catalyst is dependent on the process chemistry and the desired throughput. By implementing a smart formulation strategy and managing the handling and operating conditions, JM can help maximise the catalyst utilisation and extend the catalyst life.

- ### Will the catalyst life be different in each process?

  The catalyst life will likely change depending on the chemistry and the nature of the operation. For example, the catalyst life in a batch process is typically shorter due to an increased risk of physical degradation and surface inhibition. Continuous processes are typically operated under harsher conditions, which can result in catalyst thermal sintering and carbon laydown/coke. In both cases, recycle and regeneration procedures should be considered to extend the catalyst life and improve the economics of the process.

**At JM, we are committed to helping our customers optimise their catalytic processes. Our extensive catalyst expertise and global manufacturing capability means that we can identify the best process parameters for success. Whether you're looking for an existing catalyst, customised solution, or to improve an existing process, our experts are ready to work with you.**

To find out more visit matthey.com/hetcat

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