



JM

# Sponge Metal catalysts

Solutions for the synthesis of pharmaceuticals,  
bulk and fine chemicals



Johnson Matthey  
Inspiring science, enhancing life

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# Why Johnson Matthey?

We have been leaders in our field for more than 200 years, applying unrivalled scientific expertise to enable cleaner air and improved health whilst making more efficient use of our planet's natural resources. Through continued investment in research and development, we are tackling the world's big challenges into our third century and beyond.

Our range of performance and custom catalysts highlight Johnson Matthey's (JM) extensive capabilities and expertise in the chemicals market area. With our dynamic group of dedicated and skilled people and unparalleled technical service, we meet the needs of our customers worldwide, to develop and manufacture the catalysts that optimise chemical processes.

We offer you a comprehensive portfolio of chemical catalysts, plus a range of collaboration models to produce custom-made solutions, available at commercial scale.

Our heritage in chemical processes further enables us to provide practical solutions to maximise the value of your business.

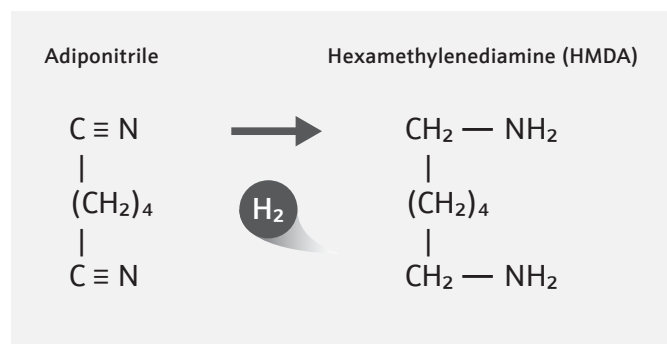
This reputation is further enhanced by our established range of products and technologies:

- PRICAT™
- HTCTM
- PURASPECT™
- PURAVOC™
- ACCENT™
- HYDECAT™
- ODORGARD™
- Sponge Metal™
- PURACARE™
- KATALCO™
- AMCAT™

# Applications

## Bulk chemicals

### Hydrogenation of nitriles to amines



#### Reaction conditions

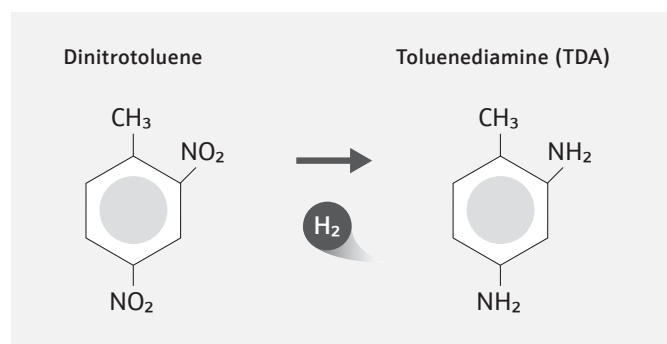
Temperature	60-100 °C
Pressure	20-50 atm
Typical catalysts	A-4000, A-40AA, A-4009, A-40F0

#### Other Applications

#### Typical catalysts

Diaminobutane	A-4000
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### Hydrogenation of nitro groups to amines



#### Reaction conditions<sup>1</sup>

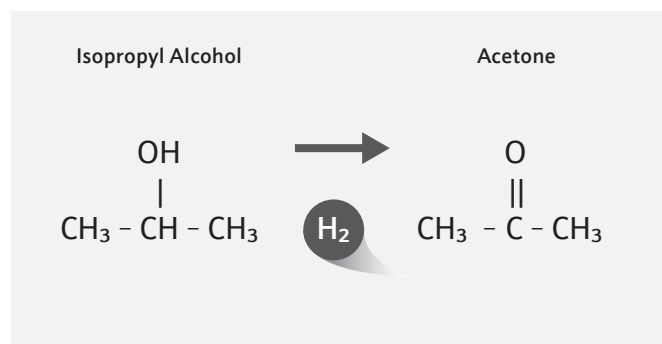
Temperature	100-200 °C
Pressure	10-200 atm
Typical catalysts	A-5000, A-6009, A-4000

#### Other applications

#### Typical catalysts

2-Nitro-2-methyl-1-propanol to 2-Amino-2-methyl-1-propanol	A-5000, A-7J63, A-7H63, A-7F63
Nitrobenzene to aniline	A-5000, A-5B09

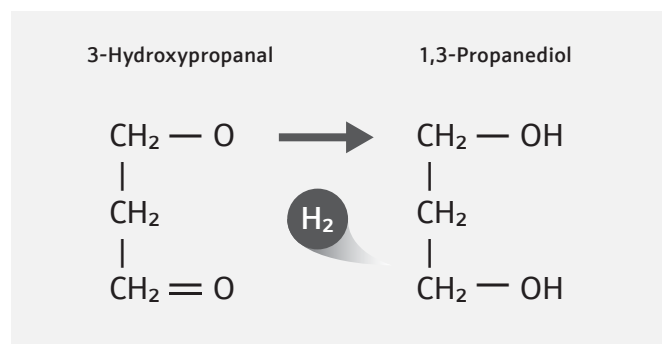
### Dehydrogenation of alcohols



#### Reaction conditions<sup>3</sup>

Temperature	170-230 °C
Typical catalysts	A-4000

### Hydrogenation of carbonyl groups



#### Reaction conditions<sup>2</sup>

Temperature	50-175 °C
Pressure	13-150 atm
Typical catalysts	A-7063, A-7B63, A-7069, A-7B69

#### Other applications

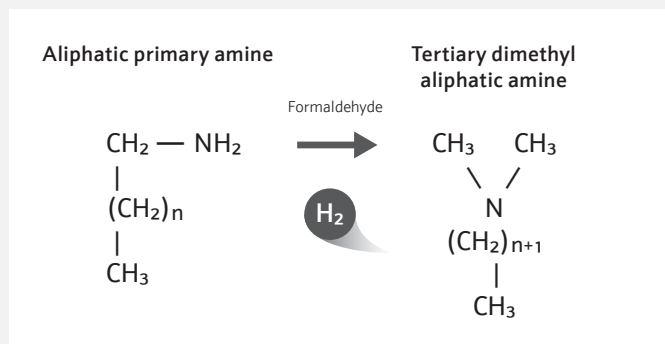
#### Typical catalysts

Butyraldehyde to butanol	A-5000, A-7063, A-7069
Benzaldehyde to benzyl alcohol	A-5000, A-7063, A-7069
2-ethylhexanal to 2-ethylhexanol	A-5000, A-7069

1. US Patent #3,935,264 (1976), US Patent #3,517,063 (1970), US Patent #4,224,249 (1980)
2. US Patent #5,463,144 (1995)
3. US Patent #4,380,673 (1983)

## Specialty chemicals

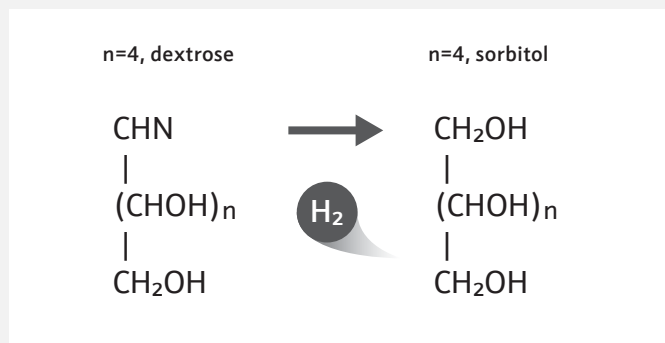
### Reductive alkylation



#### Reaction conditions

Temperature	150-150 °C
Pressure	1-3 atm
Typical catalysts	AMCAT-5, AMCAT-5343, A-5000

### Hydrogenation of polyols



#### Reaction conditions

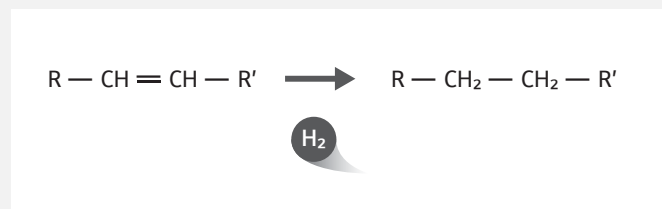
Temperature	100-150 °C
Pressure	20-200 atm
Typical catalysts	A-7063, A-7B63, A-7069, A-7B69, A-7KF3

#### Other applications

#### Typical catalysts

Mannitol	A-7063, A-7B63, A-7KF3, A-7069, A-7B69
Maltitol	A-7063, A-7B63, A-7KF3, A-7069, A-7B69
Xylitol	A-7063, A-7B63, A-7KF3, A-7069, A-7B69
Lactitol	A-7063, A-7B63, A-7KF3, A-7069, A-7B69

### Hydrogenation of olefins to alkanes



#### Reaction conditions

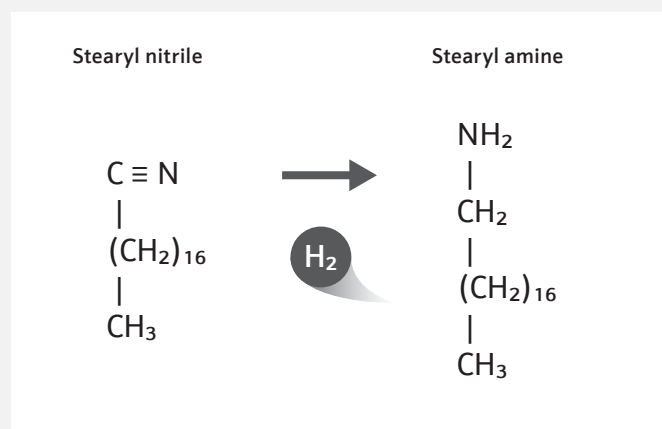
Temperature	25-200 °C
Pressure	1-200 atm
Typical catalysts	A-5000, A-5B09

#### Other applications

#### Typical catalysts

Crotonaldehyde to butyraldehyde	A-5000, A-5B09
Sulfolene to sulfolane	A-5000, A-5B09

### Hydrogenation of fatty nitriles to fatty amines USING AMCAT CATALYSTS

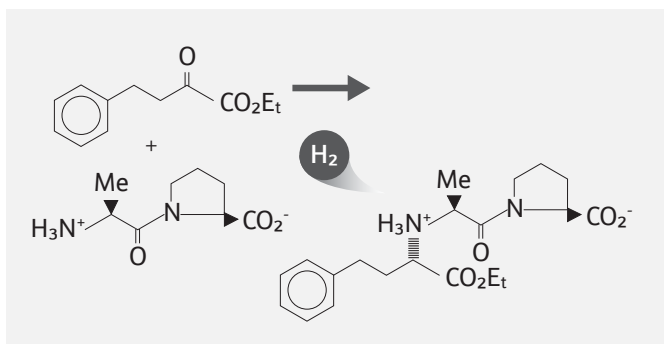


#### Reaction conditions

Temperature	40-200 °C
Pressure	10-30 atm
Typical catalysts	AMCAT-5, A-8B46, A-5000

## Pharmaceuticals

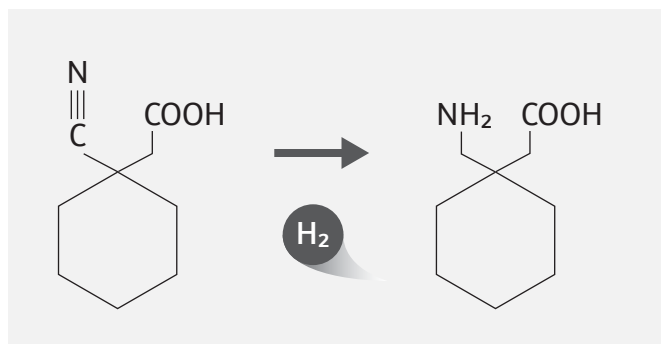
### Reductive alkylation (stereoselective)<sup>4</sup>



#### Reaction conditions

Temperature	RT
Pressure	3 atm
Typical catalysts	A-5000, A-5B09

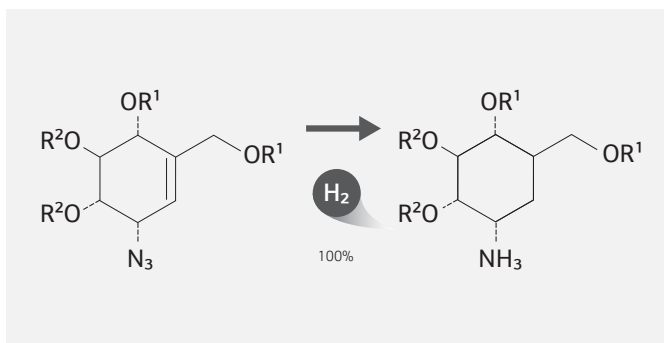
### Hydrogenation of nitriles to amines<sup>5</sup>



#### Reaction conditions

Temperature	RT
Pressure	12 atm
Typical catalysts	A-5000, A-5B09, A-7063, A-7B69

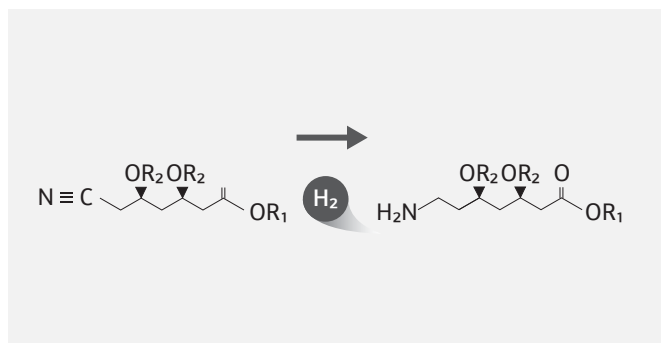
### Hydrogenation of azide and olefin<sup>6</sup>



#### Reaction conditions

Temperature	RT
Pressure	3 atm
Typical catalysts	A-5000, A-5B09

### Hydrogenation of nitriles to amines<sup>7</sup>



#### Reaction conditions

Temperature	RT
Pressure	3 atm
Typical catalysts	A-5000, A-5B09, A-7063, A-7B69

4. Journal of Organic Chemistry (1988), 53(4) 836-44, Tetrahedron Letters (1999), 40(5), 831-834

5. US Patent #5,132,451 (1992)

6. ChemReviews 2003, (103), 1973

7. Tetrahedron Letters (1992), 33(17), 2283-84

# Product listing

Sponge family	Catalysts	Primary active component	Promoters	Typical median particle size, $\mu\text{m}$	Comments
Nickel	A-2000	Nickel	Fe	33	Standard catalysts
	A-5000	Nickel	–	33	Standard catalysts for most hydrogenation reactions
	A-5009	Nickel	–	33	High clarity and fast filtration rate
	A-5B09	Nickel	–	43	High clarity and fast filtration rate
	A-5F00	Nickel	–	85	Fast settlement and fast filtration
	A-5200	Nickel	–	111	Fast settlement and fast filtration
Nickel/molybdenum	A-70C3	Nickel	Mo	33	Standard catalysts
	A-7063	Nickel	Mo	33	Standard catalysts
	A-7069	Nickel	Mo	33	Excellent settlement and fast filtration
	A-7KF3	Nickel	Mo	39	Excellent settlement and fast filtration
	A-7K69	Nickel	Mo	39	Excellent settlement and fast filtration
	A-7B63	Nickel	Mo	43	Standard catalysts
	A-7B73	Nickel	Mo	43	Standard catalysts
	A-7B69	Nickel	Mo	43	Excellent settlement and fast filtration
	A-7BC9	Nickel	Mo	43	Excellent settlement and fast filtration
	A-7J63	Nickel	Mo	50	Fast settlement and fast filtration
	A-7H63	Nickel	Mo	55	Fast settlement and fast filtration
	A-7F63	Nickel	Mo	85	Fast settlement and fast filtration
	A-7263	Nickel	Mo	111	Fast settlement
	Nickel/chromium	A-4000	Nickel	Fe/Cr	33
A-40F0		Nickel	Fe/Cr	33	High Al
A-4009		Nickel	Fe/Cr	33	High clarity and fast filtration rate
A-40AA		Nickel	Fe/Cr	33	Modified Fe/Cr ratio
Ni/palladium	A-6009	Nickel	Pd	33	Significant high activity for nitro hydrogenation
Cobalt	A-8B46	Cobalt	Ni/Cr	60	High selectivity in some applications
AMCAT	AMCAT-5	Nickel	–	33	Primary amine coated
	AMCAT-5343	Nickel	–	33	Tertiary amine coated

Please note these are typical values and not specifications.

Alloy Powders - All precursor catalysts alloy powders along with custom alloy powders are available upon request

# Manufacturing

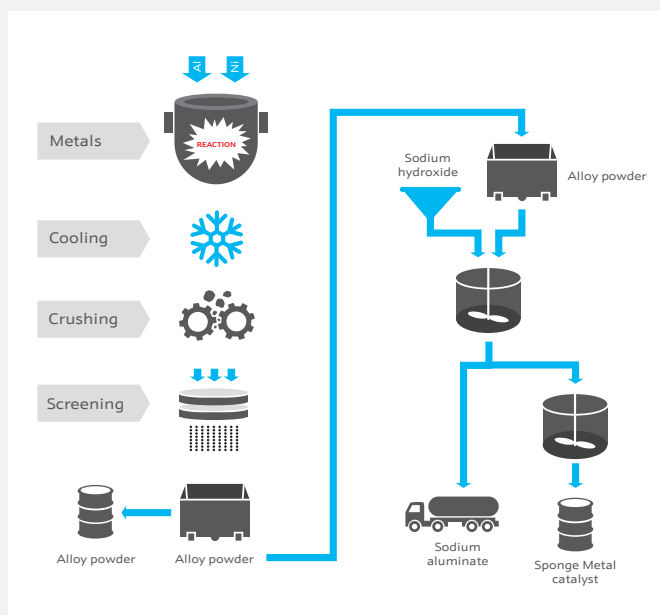
JM's **Sponge Metal** catalysts manufacturing site is located in Sevierville, Tennessee, USA, at the foothills of the beautiful Great Smoky Mountains. The production plants and laboratories are modern facilities capable of producing high quality alloy powders and activated catalysts with great consistency. The plant is ISO-9001:2015 and ISO-14001:2015 Halal and Kosher certified

**Sponge Metal** catalysts are prepared from alloys of transition metals and aluminum. The aluminum is leached from the alloy structure, leaving behind an active metal surface covered or saturated with adsorbed hydrogen. The activated catalysts are stored under water to protect them from oxidation. **Sponge Metal** catalysts are in a fully active form when shipped and require no preactivation prior to use.

JM operates its manufacturing facilities with maximum effort and commitment to produce a safe and sustainable product in a safe working atmosphere with minimum detrimental effect on the environment.

## Manufacturing process

In 1927, a patent<sup>8</sup> was awarded to Murray Raney of Tennessee for a new class of metal catalysts produced from the alloys of various base metals with aluminum.



8. Murray Raney, US Patent 1,628,190 (1927)





# Customer service

JM is committed to providing our customers with the best services. Our global sales network offers prompt responses to customer needs. Our knowledge and expertise enable us to provide our customers with excellent technical service:

- Catalysts screening service
- Process optimisation
- Process troubleshooting
- Tailored catalysts
- Technical training seminars
- Ni recovery from spent catalysts



## AMCAT specialty encapsulated catalysts

Proprietary **AMCAT** catalysts are activated **Sponge Metal** encapsulated catalysts in which water has been displaced by an aliphatic amine. They offer unique handling and safety properties, as well as being highly effective catalysts. **AMCAT** catalysts provide plant operations with the following benefits:

- Non-pyrophoric
- Non-dusting
- Easy to weigh
- No water added to process
- No preactivation
- Size of **AMCAT** can be adjusted
- Various amine coatings available for direct compatibility with customer's product

# Sponge Metal catalysts recovery

JM offers services for reclamation of metal value from spent catalysts. After use, the spent catalysts should be handled carefully in the following post-treatment and storage method, due to their pyrophoric property.

Spent catalysts residues are classified as materials for recycling, and the transport of these residues are subject to current regulations. In addition to the regulations governing waste shipments, all movements of catalysts residues must be classified and labeled according to current international transport regulations. Material originating within the European Union must also be classified and labeled for supply in accordance with Directive 1999/45/EC.

To ensure safe treatment of the residues and to meet European Health and Safety legislation, JM requires a Safety Data Sheet for each residue returned. Other material contaminated with base metals, such as wipes, filter cloths, distillation residues, etc., should be returned in a separate marked drum for metal reclamation.

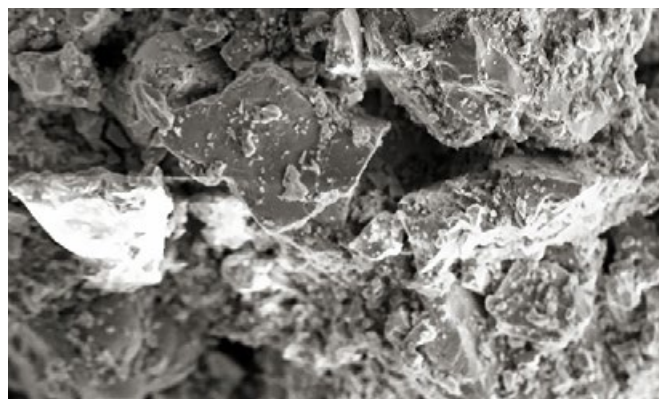


## Storage handling & safety

Activated **Sponge Metal** catalyst are pyrophoric. Catalysts should be stored in sealed containers until required for use. Drums should be kept in a cool, dry place under reasonable conditions (not exposed to the elements of weather and extremes of temperatures – ideally kept between 5 - 30°C). Drums should not be stored near oils or flammable liquids or exposed to combustible vapors due to the risk of fire.

After use, empty drums can often be retained for shipment of spent catalysts for recycling. Catalysts are shipped under a protective layer of water to prevent immediate oxidation by air. In most cases, spent catalysts are just as pyrophoric as fresh catalysts, and should be handled with the same caution. In the event of a splash or spill, please refer immediately to the Safety Data Sheet (SDS) for detailed up-to-date information about hazards

and safe handling recommendations. If any further information is required, please contact your local sales representative or any local sales office listed on the back of this brochure.



# Standard packaging

Product packaging can be customised. Packaging options provide many benefits to production plant operators, warehouse personnel, health and safety professionals, and supply chain managers.



- English or metric weights and measures
- International labeling to conform with all current legislation
- Client product code information
- Matching drum weight with process batch size to prevent errors associated with weighing or scooping
- Color coding of drum for inventory control and batch size procedures
- Optional drum liners can help with drum emptying in certain types of equipment
- Steel drums may be reused for shipping spent catalysts to the metal reclaimer (if permitted by local regulations)

## Sponge Metal catalysts standard packaging

Catalysts are shipped as water-based slurries, with a visible excess of liquid.

Net solids weight	350lbs / 158.8kg	200lbs / 90.7kg	110lbs / 50kg	35lbs / 15.8kg
Gross volume	55 US gal / 210.8L	30 US gal / 114L	16 US gal / 60.5L	5 US gal / 18.9L
Material	All drums are steel, equipped with automatic pressure relief valves			
Shipping Classification	UN1378, Metal catalysts, wetted			

## AMCAT catalysts standard packaging

Net solids weight	350lbs / 158.8kg	35lbs / 15.8kg
Gross volume	55 US gal / 210.8L	5 US gal / 18.9L
Material	Steel	Plastic
Shipping Classification	UN1759, corrosive solids, n.o.s.	

Designed and produced by [www.houseoftype.co.uk](http://www.houseoftype.co.uk)

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