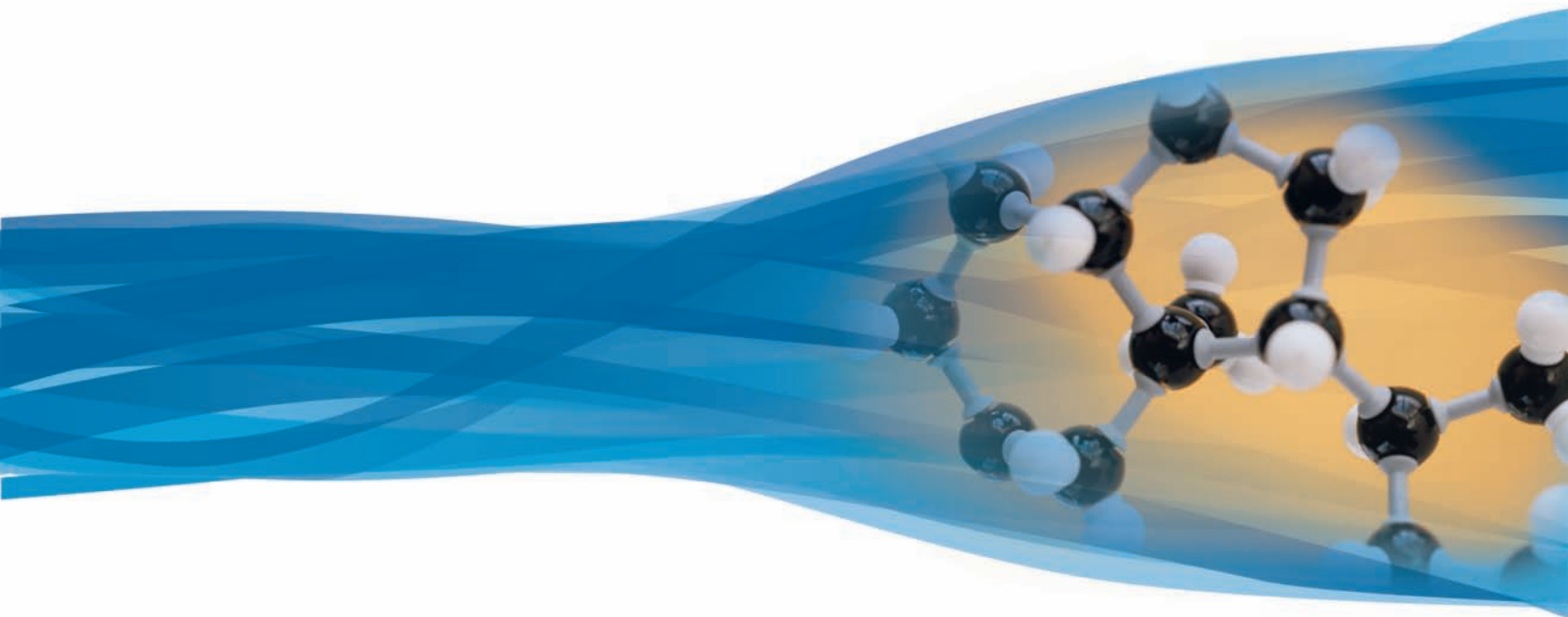


Sponge Metal™ Catalysts

Solutions for the Synthesis of Pharmaceuticals, Bulk and Fine Chemicals



Johnson Matthey
Catalysts



About Johnson Matthey

Johnson Matthey is a recognized world leader in precious and base metal catalysis. With staff in over 30 countries, our extensive network of resources enables us to provide a full range of services and products. These include the development and manufacture of catalysts and chemicals, analytical and characterization techniques, and the recovery and refining of Platinum Group Metals (PGM) from spent catalysts.

Johnson Matthey has continued to develop its technology for nearly 200 years, demonstrating the company's ability to maintain world leadership by adapting constantly to rapidly changing customer needs. Rigorous in its own environmental policies, many of Johnson Matthey's products have a major beneficial impact on the environment and enhance the quality of life for millions around the world.



World Headquarters
Royston, UK

Sponge Metal™ Catalysts Manufacturing



Johnson Matthey'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 became ISO-9002 certified in 1993 and ISO9001-2000 certified in 2005.

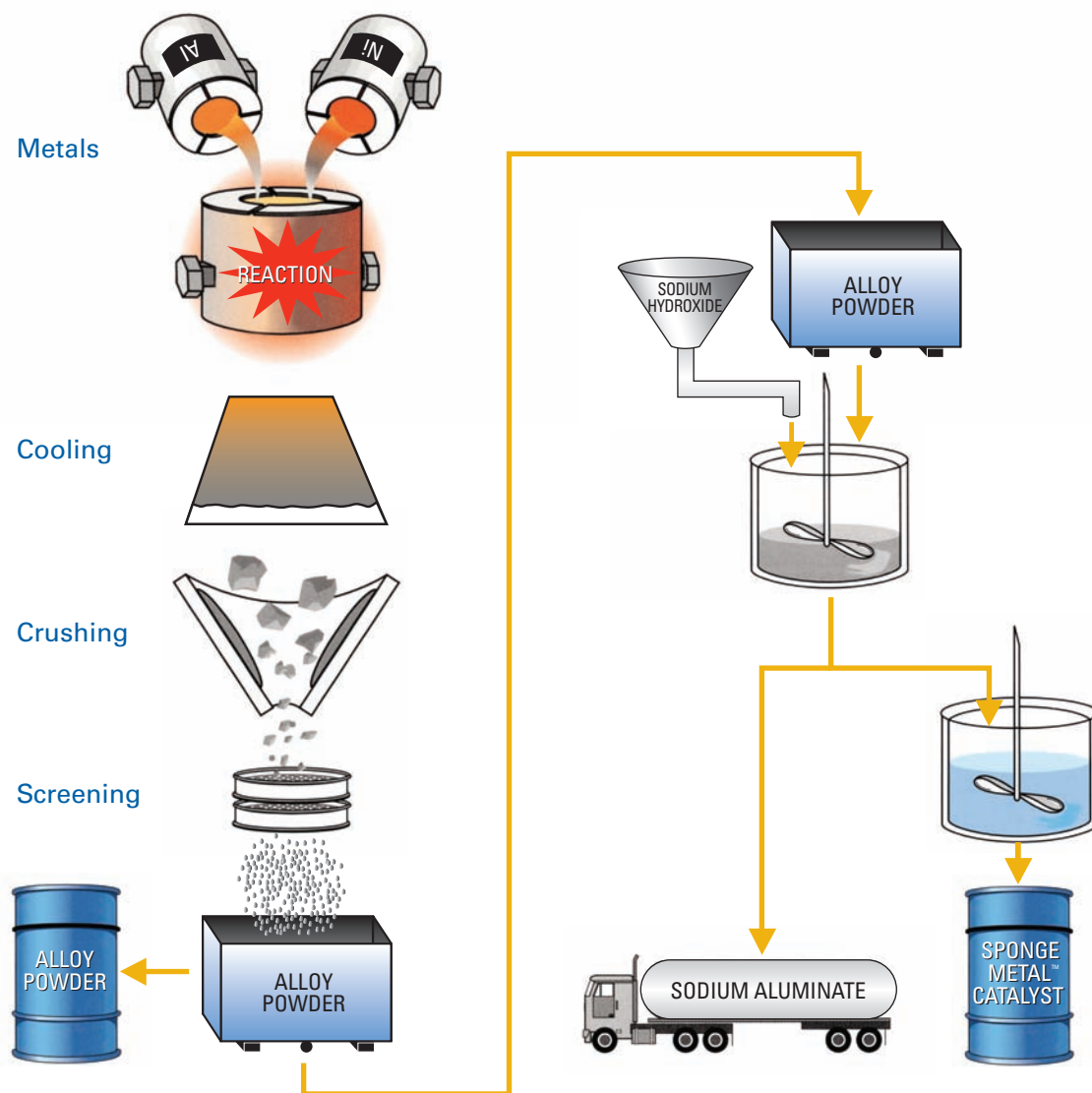
Sponge Metal™ Catalysts are prepared from alloys of transition metals and aluminum. The aluminum is leached from the alloy structure, leaving behind an active metal surface covered or saturated with adsorbed hydrogen. The activated catalysts are stored under water to protect them from oxidation. Sponge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

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



Sevierville, Tennessee USA

Sponge Metal™ Catalysts Manufacturing Process



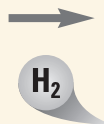
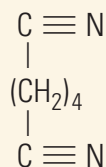
In 1927, a patent¹ was awarded to Murray Raney of Tennessee for a new class of metal catalysts produced from the alloys of various base metals with aluminum.

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

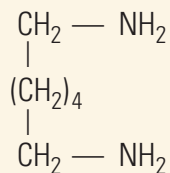
Bulk Chemicals

Hydrogenation of Nitriles to Amines

Adiponitrile



Hexamethylenediamine (HMDA)



Reaction Conditions

Temperature 60-100°C

Pressure 20-50 atm

Typical Catalysts A-4000, A-400A, A-4F00

Other Applications

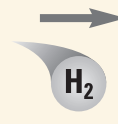
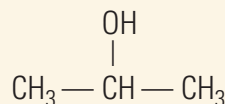
Diaminobutane

Typical Catalysts

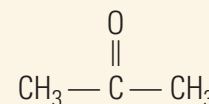
A-4000

Dehydrogenation of Alcohols

Isopropyl Alcohol



Acetone



Reaction Conditions³

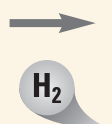
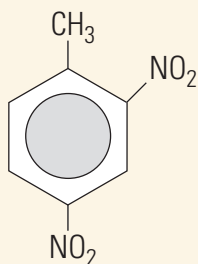
Temperature 170-230°C

Typical Catalysts

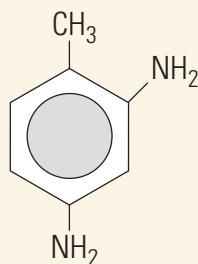
A-4000, A-7000

Hydrogenation of Nitro Groups to Amines

Dinitrotoluene



Toluenediamine (TDA)



Reaction Conditions¹

Temperature 100-200°C

Pressure 10-200 atm

Typical Catalysts

A-5000, A-6EB9, A-4000

Other Applications

2-Nitro-2-methyl-1-propanol to

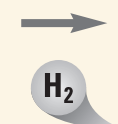
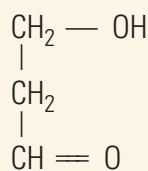
2-Amino-2-methyl-1-propanol

Typical Catalysts

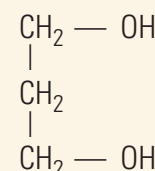
A-5000, A-7000

Hydrogenation of Carbonyl Groups

3-Hydroxypropanal



1,3-Propanediol



Reaction Conditions²

Temperature 50-175°C

Pressure 13-150 atm

Typical Catalysts A-7063,

A-7B63, A-7069, A-7B69

Other Applications

Butyraldehyde to Butanol

Benzaldehyde to Benzyl Alcohol

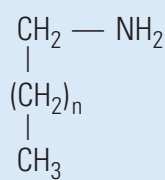
2-Ethylhexanal to 2-Ethylhexanol

Typical Catalysts A-5000, A-7000, A-7069, A-5000, A-3B00, A-7069

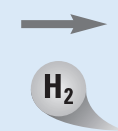
Specialty Chemicals

Reductive Alkylation

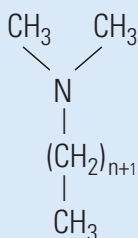
Aliphatic Primary Amine



Formaldehyde



Tertiary Dimethyl Aliphatic Amine



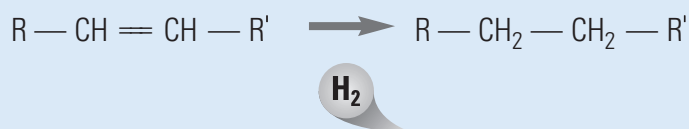
Reaction Conditions

Temperature 150-180°C

Pressure 1-3 atm

Typical Catalysts AMCAT-5, A-7B63
AMCAT-5343, A-5000, A-7000

Hydrogenation of Olefins to Alkanes



Reaction Conditions

Temperature 25-200°C

Pressure 1-200 atm

Typical Catalysts A-5000

Other Applications

Crotonaldehyde to Butyraldehyde

Sulfolene to Sulfolane

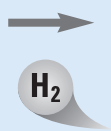
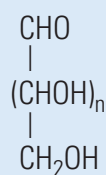
Typical Catalysts

A-5000

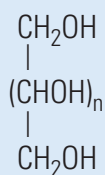
A-5000

Hydrogenation of Polyols

n=4, Dextrose



n=4, Sorbitol



Reaction Conditions

Temperature 100-150°C

Pressure 20-200 atm

Typical Catalysts
A-7063, A-7B63, A-7069, A-7B69

Other Applications

Mannitol A-7063, A-7B63, A-7B73, A-7069, A-7B69

Maltitol A-7063, A-7B63, A-7B73, A-7069, A-7B69

Xylitol A-7063, A-7B63, A-7B73, A-7069, A-7B69

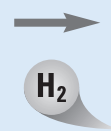
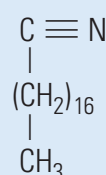
Lactitol A-7063, A-7B63, A-7B73, A-7069, A-7B69

Typical Catalysts

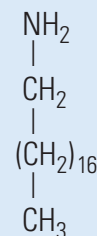
Hydrogenation of Fatty Nitriles to Fatty Amines

USING AMCAT® CATALYSTS

Stearyl Nitrile



Stearyl Amine



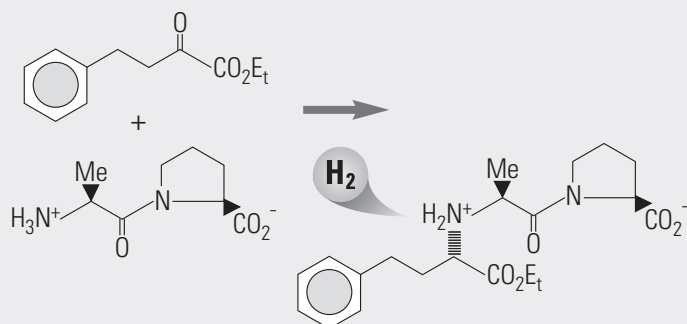
Reaction Conditions

Temperature 40-200°C

Pressure 10-30 atm

Typical Catalysts AMCAT-5,
AMCAT-7, A-7B63, A-8B46

Pharmaceuticals

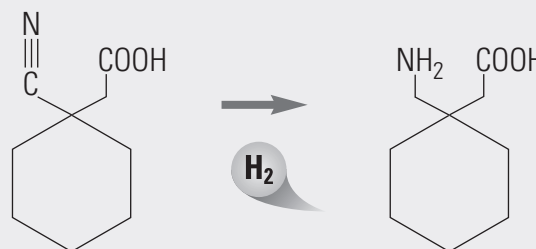
Reductive Alkylation (Stereoselective)⁴

Reaction Conditions

Temperature RT

Pressure 3 atm

Typical Catalysts A-5000

Hydrogenation of Nitriles to Amines⁵

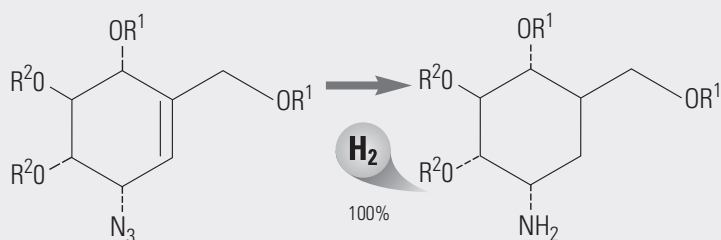
Reaction Conditions

Temperature RT

Pressure 12 atm

Typical Catalysts

A-7000, A-5000, A-7063, A-706B

Hydrogenation of Azide and Olefin⁶

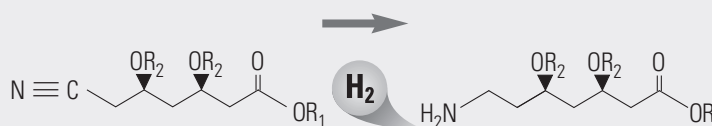
Reaction Conditions

Temperature RT

Pressure 3 atm

Typical Catalysts

A-5000, A-5E09

Hydrogenation of Nitriles to Amines⁷

Reaction Conditions

Temperature RT

Pressure 3 atm

Typical Catalysts

A-7000, A-5000, A-7069

Sponge Metal™ Catalysts Product Listing

Sponge Family	Catalysts	Primary Active Component	Promoters	Typical Median Particle Size, µm	Comments
Nickel	A-2000	Nickel	Fe	30	Standard catalysts
	A-5000	Nickel	–	33	Standard catalysts for most hydrogenation reactions
	A-5001	Nickel	–	33	Standard catalysts at low pH
	A-5009	Nickel	–	33	High clarity and fast filtration rate
	A-5E09	Nickel	–	20	High clarity and high activity
	A-5B00	Nickel	–	50	Standard catalysts for most hydrogenation reactions
	A-5F00	Nickel	–	85	Fast settlement and fast filtration
	Nickel/Molybdenum	A-7000	Nickel	Mo	35
A-7004		Nickel	Mo	35	High activity after recycling
A-7063		Nickel	Mo	35	Standard catalysts
A-7B63		Nickel	Mo	50	Standard catalysts
A-7B73		Nickel	Mo	50	Standard catalysts
A-7200		Nickel	Mo	160	Fast Settlement
A-7069		Nickel	Mo	35	Excellent settlement and fast filtration
A-7B69		Nickel	Mo	50	Excellent settlement and fast filtration
A-7BC9		Nickel	Mo	50-65	Excellent settlement and fast filtration
Nickel/Chromium		A-4000	Nickel	Fe/Cr	35
	A-4F00	Nickel	Fe/Cr	85	Fast settlement and filtration
Ni/Palladium	A-6EB9	Nickel	Pd	20	Significant high activity for nitro hydrogenation
Copper	A-3B00	Copper	–	35	Standard sponge copper catalysts
Cobalt	A-8B46	Cobalt	Fe/Cr	35	High selectivity in some applications
AMCAT®	AMCAT-5	Nickel	–	35	Primary amine coated
	AMCAT-5343	Nickel	–	35	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

Customer Service

Johnson Matthey 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 Optimization
- Process Trouble Shooting
- 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 (a typical size: ½ inch cubes)
- Various amine coatings available for direct compatibility with customer's product

Sponge Metal™ Catalysts Recovery

Johnson Matthey 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, Johnson Matthey requires a Material 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™ Catalysts 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 3 to 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 Material Safety Data Sheet (MSDS) 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.

Good practice dictates, as with all substances, that exposure to this substance be minimised. Further, more detailed information on health and safety matters is given with Johnson Matthey Catalysts products literature.



Johnson Matthey
Catalysts

Standard Packaging for Sponge Metal™ and AMCAT® Products

Packaging can be customized. 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, pounds (kg)	350 (158.8)	200 (90.7)	110 (50)	35 (15.8)	12 (5)
Gross Volume, gallons (US) (liters)	55 (210.8)	30 (114)	16 (60.5)	5 (18.9)	3 (11.5)
Material	All drums are steel, equipped with automatic pressure relief valves				
Shipping Classification	UN1378, Metal Catalysts, Wetted				

AMCAT® Catalysts Standard Packaging

Net Solids Weight, pounds (kg)	350 (158.8)	35 (15.8)
Gross Volume, gallons (US) (liters)	55 (210.8)	5 (18.9)
Material	Steel	Plastic
Shipping Classification	UN1759, Corrosive Solids, n.o.s.	



Johnson Matthey Catalysts

For further information about our products or to talk to us about your individual requirements,
please contact your local sales office or contact us at the addresses below.

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