

Shepherd
Since 1916

What's Your Catalyst Destination?

**Shepherd Chemical's
Catalyst Co-Development
Opportunities**



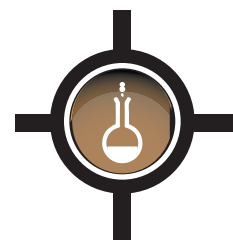
Explore the Possibilities.

Shepherd's Approach to Custom Catalysts



CREATING VALUE WITH METAL CHEMISTRY

Our 100 year history makes us a highly valued and trusted partner for metal chemistry technologies and catalyst development. Our distinguished team of metal chemistry experts specialize in inorganic and organic synthesis. We innovate and implement advanced chemistry technologies, from the benchtop to full-scale production.



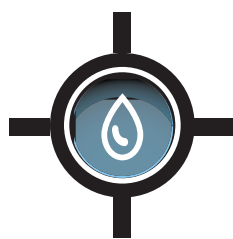
SMALL-SCALE CATALYST MANUFACTURING

Whether you need to scale-up 1000 grams or manufacture 1000 tons of product, we have the equipment and capabilities to meet your manufacturing needs using our broad range of processing facilities.



ECONOMIC & ECO-FRIENDLY MANUFACTURING

Catalyst production using organic solvents results in large volumes of volatile organic waste, which is economically and environmentally unfavorable. Curtailing the use of organic solvents is a priority at Shepherd.



AQUEOUS EXPERTISE

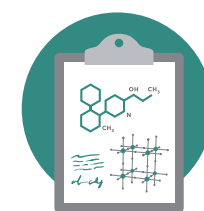
Complex catalyst production can often be simplified by producing the catalyst under precise aqueous conditions. If you feel constrained by your organic ligand, we can often innovate the particle itself to remove the need for solvent.



ASSURED CONFIDENTIALITY

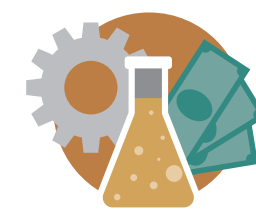
We work with companies to custom co-develop chemicals, supplying our customers with high quality product and allowing them to retain the IP associated with the material and its applications.

More than 50% of our production is custom co-developed with our customers.



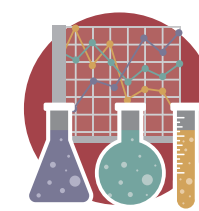
DESCRIBE

the opportunity at a high level, under NDA, including key commercial and technical targets.



DEFINE

the project by identifying key requirements, including formulations, process conditions, and potential show stoppers.



DISCOVER

the best route to the project target by implementing our expertise in chemical process development.



DEVELOP

the best chemical process by applying our world class scale-up capabilities.

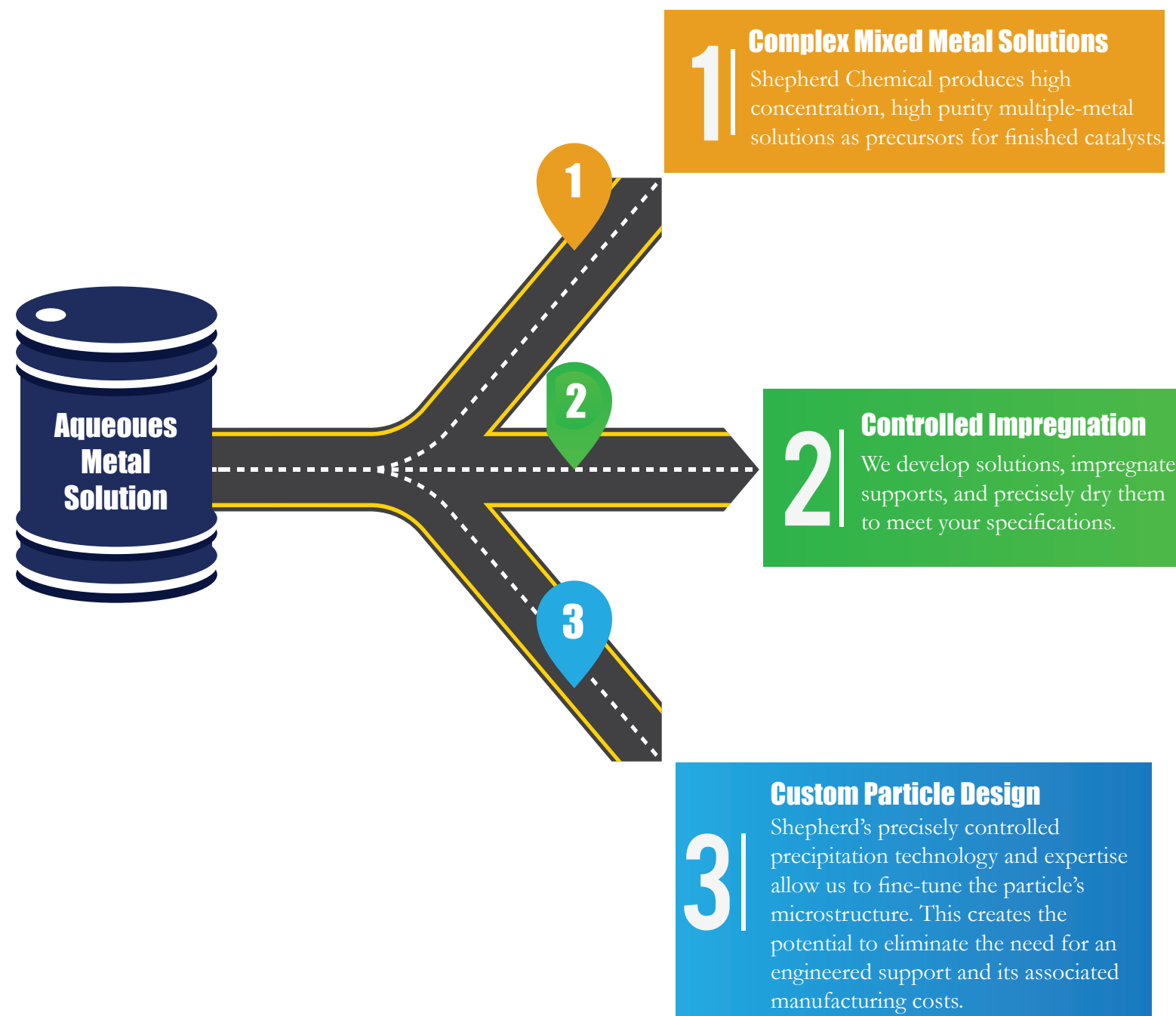


DELIVER

the commercial product to the satisfaction of our customer.



The Shepherd Advantage for Custom Heterogeneous Catalyst Development

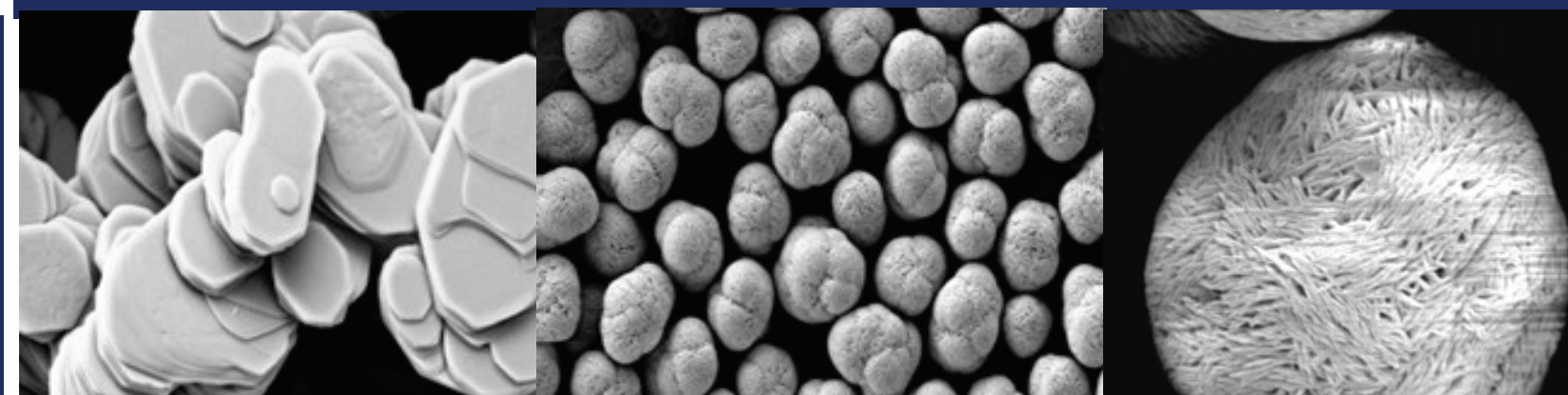


Partner with Shepherd Chemical to co-develop and manufacture your specialty heterogeneous catalysts. Our metal chemistry and particle engineering expertise enable us to create innovative and cost-effective manufacturing processes.

Consider the Aqueous Precipitation Route.



Shepherd Chemical leverages decades of aqueous precipitation experience to design highly engineered particles, and potentially eliminate the need for a catalyst support. This method of catalyst preparation makes us capable of designing high-performance catalysts and catalyst precursors with intimate mixtures of different metals or discrete domains of individual metals.



In the 1930s, scientists discovered that copper could catalyze a reaction between formaldehyde and acetylene to form 1,4-butyne-1,3-diol. Much later in the 1970s, scientists at DuPont collaborated with The Shepherd Chemical Company to develop a custom designed bismuth-doped copper carbonate catalyst precursor that helped fuel this technology’s resurgence. **Shepherd finely tuned particle size, surface area, morphology, consistency and stability and as such, we have remained the SCC supplier of choice in this industry.**

SCC acts as an ethynylation catalyst for the production of Spandex. It reduces the operating pressure in the manufacturing of butyne-1,3-diol from 20 bar to 1 bar, reducing the risk of explosion to operators. Over the years, Shepherd Chemical has consistently served as the trusted partner to make innovative advancements to the design of this vital catalyst precursor technology. Today, 15 plants that use SCC technology- a 5-fold increase from three years ago. Through generations of improvements, we have achieved the best-performing catalyst at the best price point, with an overall 5/6th cost reduction.

Our most recent innovation, **SCC-XL**, was designed to enhance performance, optimize surface area, limit particle fracturing, and ultimately increase catalyst lifetime during the 1,4-butyne-1,3-diol manufacturing process.



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Spherical Copper Carbonate

Case Study

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Majority Supplier with >50% Market Share

Ethynylation Catalyst

Reduces Operating Pressure from 20 to 1 bar

15 Plants Utilizing SCC Technology

5/6 Cost Reduction

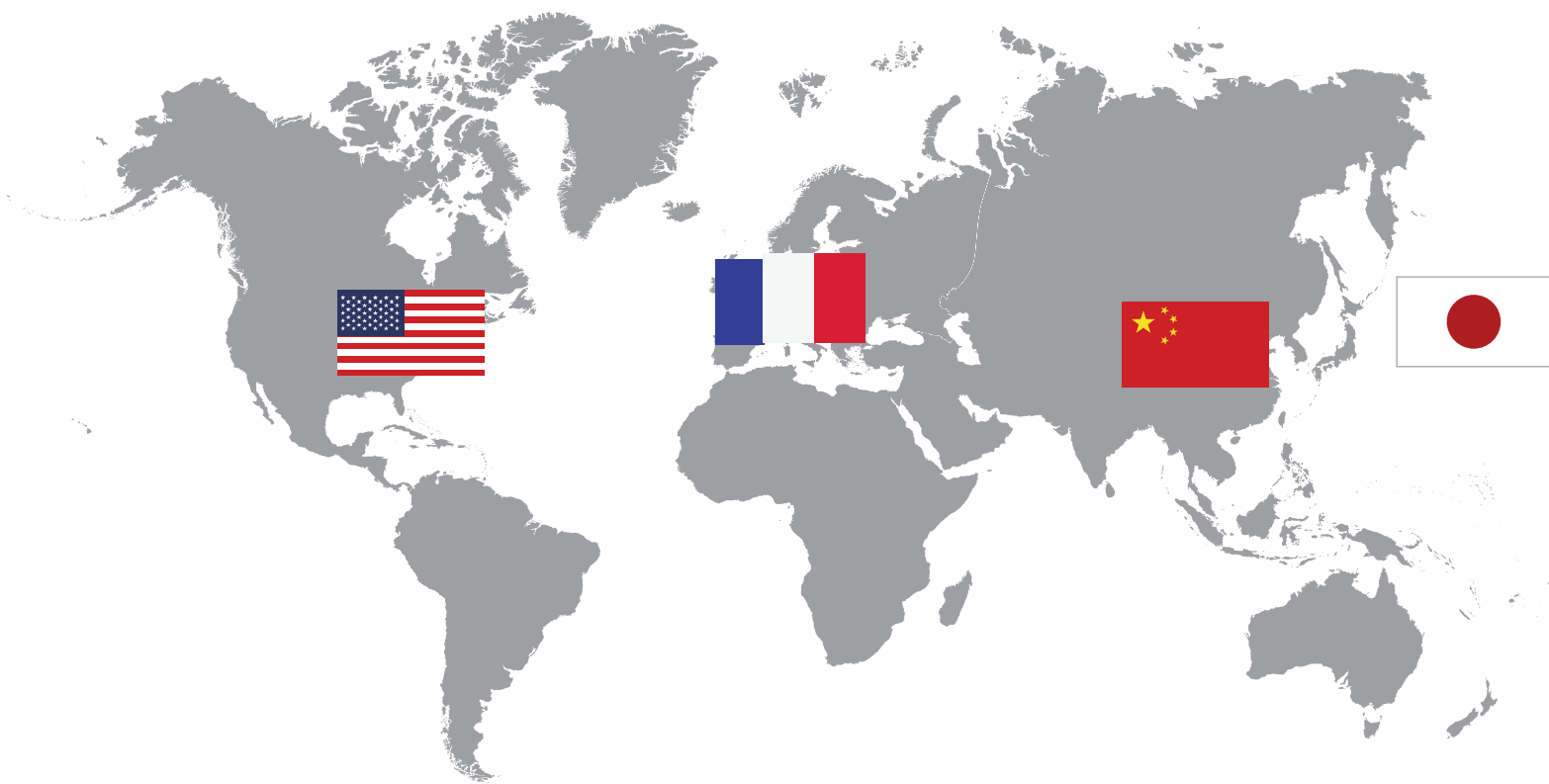
Increases Manufacturer Safety

“ Shepherd and DuPont co-developed a process for aqueous precipitation of “crystalline particles of basic copper carbonate having uniformly dispersed therein bismuth”
-US Patent 4107082 A ”

- Reduces operation costs by:**
- Reducing filter clogging to extend run length
 - Minimizing down time
 - Decreasing the number of catalyst change outs

Navigate the Road to Custom Catalysts Together with The Shepherd Chemical Company

Our 100 year history as a family owned expert chemical manufacturer makes us a trusted partner for the creation of customized chemical solutions. Our metal chemistry experts design and enhance the catalyst development process, working with you hand-in-hand from the laboratory synthesis to pilot development and through rapid scale-up. We manufacture catalysts for world-wide use and distribution, with a range of applications including refining, gas-to-liquids, emission control, and chemical oxidation.



Shepherd's Catalyst Development Capabilities



Manufacturing Conditions



Temperature -30° to 250°C

Pressure up to 150 psig



Anhydrous Processing

Inert Atmosphere Processing

Wide-Range Facilities

Aqueous Chemistry Pilot Plant

50 – 1000 Gallons
316L Stainless and Glass
Filters and Driers

Organics Pilot Plant

Class 1, Div. 1
20-500 Gallons
316L Stainless and Hastelloy

Laboratory

Modern, Fully-equipped
Complete In-House Material Characterization

8
of the
Top 10
Chemical Companies
Trust Shepherd

“ Shepherd Chemical is the only specialty chemical raw material supplier that has quite a breadth of chemical capabilities and they’re willing to work with you to come up with the right molecule.
-Senior Chemist,
Top 5 Integrated
Oil & Gas Company ”



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Creating Value, Brightening Lives

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