Hydrometallurgy – Enhanced Extraction: Energy, Base, Precious and Rare Earth Metals

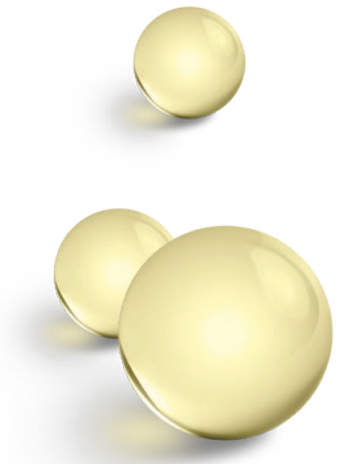
Energy, Base, Precious and Rare Earth are essential raw materials for electronic devices, electricity generation and many of today's consumer and industrial products. Mining these metals has evolved into a specialized skill. DuPont enables highly sophisticated hydrometallurgy operations and processes – from in-situ leaching (ISL) and Resin-in-Pulp to selective recovery and purification. Through the development of metal selective ion exchange (IX) media and application expertise, DuPont products and technologies have helped the mining industry recover valuable metals in an efficient and environmentally sustainable manner for decades.

Hydrometallurgy Offerings and Solutions

Function	DuPont Product	Description
Ion Exchange Resins	DuPont™ AmberSep™	For the extraction, separation and purification of base, precious and rare earth metals, as well as uranium. Applicable in a wide range of operations and processes.
Membrane Filtration	FilmTec™ Nanofiltration DuPont™ IntegraTec™ Ultrafiltration	Nanofiltration Membranes Ultrafiltration Membranes

The AmberSep™ Family of Resins

DuPont ™ AmberSep™ products are a family of Ion Exchange resins for hydrometallurgical extraction. These gel/macroporous, styrenedivinyl benzene, copolymer beads are available with a wide range of functional groups and particle sizes for extracting precious and industrial metallic ions from process solutions. The table below lists common extraction applications where DuPont ™ AmberSep™ is used. Ultrafiltration (UF) and Nanofiltration (NF) technologies have recently been used in purification and recycle of reagents used in metals extraction.



Application	DuPont Product	
Copper, Nickel, Cobalt	DuPont™ AmberSep™ M4195 DuPont™ AmberSep™ M4195 DuPont™ AmberSep™ M4196 UPS	Chelating ion exchange resin for electrolyte refining and metal extraction pH<2
Transition metals	DuPont™ AmberSep™ IRC747 UPS DuPont™ AmberSep™ IRC748 DuPont™ AmberSep™ IRC748 UPS	Chelating ion exchange resin for extraction of transition metals
Precious Group Metals Heavy Metals – Mercury Boron	DuPont™ AmberSep™ 43600 DuPont™ AmberSep™ GT74 DuPont™ AmberSep™ GT75 DuPont™ AmberSep™ IRA743	Chelating ion exchange resin Refining, Chemical Processing
Uranium	DuPont™ AmberSep™ 21K XLT DuPont™ AmberSep™ 21K 16-20 DuPont™ AmberSep™ RPU DuPont™ AmberSep™ 920U DuPont™ AmberSep™ 920U XL DuPont™ AmberSep™ 400 DuPont™ AmberSep™ 4400	Strong Base Anion resins supplied in Cl, SO_4, HCO_3 ionic forms for Acid/Alkaline leach, applicable in fixed/fluidized beds, CCIX, NIMCIX, U shape/Higgins, Porter, In-situ-Leach, RIP
Gold	DuPont™ AmberSep™ 91419 DuPont™ AmberSep™ 91419 XL	Selective recovery from Cyanide leach, applicable in fixed beds or RIL/RIP
Reagent recycle	DuPont™ IntegraTec™ PES-UF FilmTec™ Specialty NF	H_2SO_4 / H_3PO_4 / Na_2CO_3

DuPont's History in the Mining Industry

Since our earliest roots, producing black powder for mining in Alaska and the Northwest territories since 1906 , pioneering chemistries for Ion Exchange Resins in the early 1950's, to developing innovative membrane technologies for water treatment and reuse today, DuPont has continued to innovate to help customers extract more value in the mining industry. DuPont is a world leader in Membranes (RO/NF/UF) and Ion Exchange technologies, and provides a powerful portfolio of chemistries and solutions to address:

- Primary metals extraction hydrometallurgy
- Separation and Purification
- Acid Mine Drainage
- Mine water management, including tailings and waste treatments
- Recycling of metals focused on maximizing metal recovery utilizing selective ion exchange chemistries and Membranes technologies

Commitment to Sustainability

DuPont underscoring the importance of sustainability in fulfilling its purpose of delivering essential innovations to help societies thrive. The nine long-term goals are based on a critical assessment of the company's capabilities coupled with the feedback of customers and stakeholders. The goals also draw inspiration from the United Nations Sustainable Development Goals (SDGs) to identify the world's most important problems that need to be solved. DuPont's 2030 goals set forth our priorities and align to the sustainability challenges that offer the greatest opportunity to deliver business value, increase resiliency across our value chains and enable people and societies to thrive. We are focused on innovating solutions while protecting and empowering our people and the planet. We pledge to work tirelessly over the course of the next decade to make meaningful progress against our nine goals.

Product Stewardship

DuPont has a fundamental concern for all who make, distribute, and use its products, and for the environment in which we live. This concern is the basis for our product stewardship philosophy by which we assess the safety, health, and environmental information on our products and then take appropriate steps to protect employee and public health and our environment. The success of our product stewardship program rests with each and every individual involved with DuPont products – from the initial concept and research, to manufacture, use, sale, disposal, and the final recycle of each product.

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Have a question? Contact us at:
dupont.com/water/contact-us

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Form No. 45-D04569-en CDP, Rev. 0
May 2023