Indium Corporation

Corporate Strength

The Indium Corporation, founded in 1934, is the world's oldest and most experienced supplier of indium metal and indium compounds. Our capabilities extend from mining, to refining, to purification, to fabrication. World wide sourcing of raw materials, combined with our market-leading high-volume business, assures the availability of competitively-priced materials at all times. Our team of research, quality, and chemical engineers ensures that our products perform consistently in your application.

Market Focus

The Indium Corporation is an award-winning, reliable supplier of materials to the alkaline battery manufacturing market. For over 20 years, we have been a trusted partner of the world's leading battery manufacturers.

This assures you of:

- Capacity to serve ever-increasing demand
- Short lead times
- On-time deliveries
- Competitive prices
- Products that meet your requirements
- Consistent high quality
- Proven record
- Global service
- Proactive and responsive technical support
- Optimal performance from your finished products

Indium Metals and Compounds

Indium Corporation supplies all indium compounds in purities greater than or equal to 4N (99.99%). Controlled chemical impurities and concentrations, as defined by customers' requirements, are generally available. Our well-equipped laboratory, complete with the latest testing equipment, ensures the highest product consistency. Indium metal and compounds are available at all times, and are packaged in standard and customized packaging of various sizes. Material safety data sheets can be found online at www.indium.com/msds.

The element indium is well-proven for its ability to improve the performance of alkaline dry cell batteries. As a replacement for toxic mercury (Hg), indium also improves safety and reduces hazardous materials handling. Whether implementing an indium compound in a battery's electrolyte, plating it onto an anode, or using it to dope zinc powder, you can expect improved performance.

The presence of indium:

- Promotes uniform zinc metal corrosion under electrical load. This increases the battery life and improves its performance.
- Reduces outgassing. This prevents leakage, thereby increasing reliability.
- Increases the usage-life of a battery.

Indium Compound	Chemical Formula	Forms
Electrolyte Compounds:		
• Indium Oxide	In_2O_3	P
• Indium Hydroxide	$In(OH)_3$	P
• Indium Acetate	$In(CH_3COO)_3$	P
• Indium Sulfate	$In_2(SO_4)_3$	P, L
• Indium Trichloride	$InCl_3$	P, L
Indium Metal as Dopant for Zinc Powder	In (or alloy)	P, S, I, Pr
Anode Plating Compounds:		
• Indium Trichloride	$InCl_3$	P, L
• Indium Sulfate	$In_2(SO_4)_3$	L

L = liquid solution P = powder S = shot I = ingot Pr = preforms

Technical Support

Indium Corporation has a team of certified process engineers to help you select the best material for your manufacturing process. When you involve our technical experts in the initial design of your process, they can help ensure you develop an efficient and cost-effective solution. Indium Corporation has technical staff available around the globe with the skills and experience to assist you in developing your design, assembly, or process.

Technical Information

Indium Corporation offers technical information on indium compounds, including product data sheets, application notes, technical papers, and material safety data sheets.

To learn more about indium compounds, visit:
www.indium.com/inorganic-compounds/indium-compounds

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Indium Compounds for Alkaline Battery Production

- Indium Acetate
- Indium Hydroxide
- Indium Oxide
- Indium Sulfate
- Indium Trichloride

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Indium Compounds for Alkaline Battery Production

Indium Trichloride

$InCl_3$ $InCl_3 \cdot H_2O$ $InCl_3 \cdot 4H_2O$

Indium Trichloride is a white powder. It is odorless, soluble in water, and its particles are flake-shaped. It is available in two standard forms:

- Powder
- Liquid solution

Alkaline battery manufacturers add indium trichloride to the KOH electrolyte. They also use indium trichloride in a plating process to apply indium to anode collector pins.

Other applications:

- Used as a precursor for the manufacture of trimethyl-indium
- Used as a catalyst for cracking gasoline
- Used in a spray hydrolysis process to form ITO for low pressure sodium lamps

Properties

Molecular Weight:	221.18 Anhydrous
Theoretical % Indium:	51.9%
Nominal % Indium:	51%
Specific Gravity:	Solid - 3.46, apparent density N.A. Saturated solution - 1.97
Melting Point:	586°C, sublimes @ 300°C
Boiling Point:	Volatilizes @ 600°C
Solubility in Water:	66.11 g/100 g of solution at 22°C
Crystalline Form:	White plates, deliquescent
Isomorphous with:	$AlCl_3$, YCl_3
Coordination #:	6

All information is for reference only.
Not to be used as incoming product specifications.

Standard Packaging

Powder:

Quantity*	Container
• 1.8 kg	1-gallon plastic
• 0.5 kg	1-liter plastic

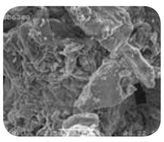
Solution:

- 1-liter polyethylene bottles
- 1-gallon polyethylene bottles
- 5-gallon polyethylene bottles

** All package sizes contain suitable desiccant. Packaging in other sizes, or in glass, may be available upon request.*

Indium Sulfate

$In_2(SO_4)_3$



Indium Sulfate is a grayish-white powder. It is hydroscopic and possesses a monoclinic prism structure. It is available in two standard forms:

- Powder
- Liquid solution

Alkaline battery manufacturers add indium sulfate to the KOH electrolyte. They also use indium sulfate in a plating process to apply indium to the pins.

Other applications:

- Used in gold electroplating solutions to produce hard gold deposits, i.e., connectors, switch controls, and PC board tabs

Properties

Molecular Weight:	517.81
Theoretical % Indium:	44.36%
Nominal % Indium:	43%
Specific Gravity:	3.438, apparent density N.A.
Crystalline Form:	White gray powder, monoclinic prisms, hydroscopic
Specific Heat:	0.129 cal/gram°C (0-100°C)
Heat of Formation:	49.039 cals ($2\,In + 3H_2SO_4 = In_2(SO_4)_3 + 3H_2$ (g)) 72.78 cals ($In_2O_3 + 3H_2SO_4$ (aqueous solution) = $In_2(SO_4)_{3\ aqss} + 3H_2O$)
Dissociation Pressure:	10 mm Hg @ 645°C 900 mm Hg @ 820°C
Solubility in Water:	53.92 g/100 g solution @ 20°C

All information is for reference only.
Not to be used as incoming product specifications.

Standard Packaging

Powder:

Quantity*	Container
• 2.5 kg	1-gallon plastic
• 0.66 kg	1-liter plastic

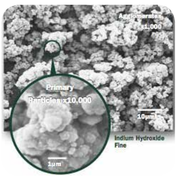
Solution:

- 1-liter polyethylene bottles
- 1-gallon polyethylene bottles
- 5-gallon polyethylene bottles

** All package sizes contain suitable desiccant. Packaging in other sizes, or in glass, may be available upon request.*

Indium Hydroxide

$In(OH)_3$



Indium Hydroxide is a white powder. It is available in two standard forms:

- Crystalline:
  Primary particles range from 1 to 5 µm in size. They are cubic-shaped and form agglomerates that are as large as 35 µm.
- Fine powder:
  Primary particles range from 0.1 to 1.0 µm in size. They range in shape from spherical to elliptical to cylindrical. Agglomerates can be as large as 5 µm.
- Other forms available upon request.

Alkaline battery manufacturers add indium hydroxide to the KOH electrolyte.

Other applications:

- Used to produce catalysts

Product Characteristics

Color:	White
Molecular Weight:	165.84
Theoretical % Indium:	69.26%
Nominal % Indium: (Fine)	65%
Nominal % Indium: (Crystalline)	69%

Standard Packaging

Quantity	Container**
• 100-200 g	Small plastic jars
• 500 g	1/2 liter
• 1 kg	1 liter
• 2.5 kg	1/2-gallon plastic
• ≥5 kg	1-gallon plastic

Physical Property Analysis

Attributes of Indium Hydroxide Powder					
Product Type	Approximate PSD Microns D90	D50	D10	Tap Density g/cc	BET m^2/g
Crystalline	35±5	17±3	<5	1.2	5-7
Fine	5±2	2±1	<1	0.8±0.2	50-65

*** Packaging in other sizes, or in glass, may be available upon request.*
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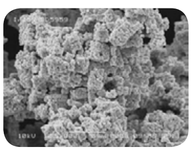
Indium Oxide

Indium Sesquioxide In_2O_3



Indium Oxide is a yellowish-white powder. It is available in two powder forms:

- Type A:
  Primary particles range from 0.4 to 1.0 µm in diameter. Agglomerates can be as large as 30 µm.
- Type B:
  Primary particles range from 0.1 to 1.0 µm in diameter. Agglomerates can be as large as 6 µm.

Alkaline battery manufacturers add indium oxide to the KOH electrolyte.

Other applications:

- Combined with tin oxide to form ITO
- Used to produce a transparent thin-film infrared-reflector

Product Characteristics

Color:	Yellow
Molecular Weight:	277.64 (82.7% In, 17.3% O)
Specific Gravity:	7.2 (Apparent density 0.5-1.2 g/cc)
Theoretical % Indium:	82.7%
Nominal % Indium:	82%

Standard Packaging

Quantity	Container**
• Up to 1 kg	3-pint plastic wide mouth jar
• 1-10 kg	1-gallon plastic wide mouth jar
• 10-20 kg	5-gallon plastic pail
• 20-30 kg	5- 8-gallon plastic drum
• ≥30 kg	16-gallon plastic or steel drum

Physical Property Analysis

Attributes of Indium Oxide Powder					
Product Type	Approximate PSD Microns D90	D50	D10	Tap Density g/cc	BET m^2/g
Type A - 99.99% In_2O_3	30±5	17±3	<5	1.4	2-3
Type B - 99.99% In_2O_3	6±3	2.5±1.5	<1	1	13-18

*** Packaging in other sizes, or in glass, may be available upon request.*
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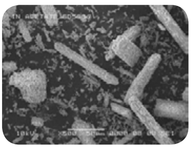
Indium Acetate

$In(CH_3COO)_3$



Indium Acetate is a white powder. It is freely soluble in mineral acid and acetic acid, and exhibits an acetic smell. Its particles are needle-shaped and it decomposes to indium oxide upon heating. It is available in one standard form:

- Powder

Alkaline battery manufacturers add indium acetate to the KOH electrolyte.

Properties

General Description:	White powder with a needle-like crystalline morphology, possessing a characteristic acetic odor
Molecular Weight:	291.86
Theoretical % Indium:	39.33%
Nominal % Indium:	43%
Tap Density:	<1
Purity:	99.99% minimum
Solubility:	Freely soluble in mineral acids and acetic acid; slightly soluble in water
Particle Size Analysis:	+60mesh, 0% -60mesh, 100%

All information is for reference only.
Not to be used as incoming product specifications.

Standard Packaging

Quantity*	Container
• 1.25 kg	1-gallon plastic
• 0.33 kg	1-liter plastic

** All package sizes contain suitable desiccant. Packaging in other sizes, or in glass, may be available upon request.*

Indium Shot

Indium Shot are teardrop-shaped pieces of pure indium metal. Typically, the shot measures 1/8" (3.175mm) in width, measured at the widest part. The tail length varies, depending on the surface tension of the alloy.

It is available in:

- Pure indium
- Indium alloys

Alkaline battery manufacturers add indium shot to zinc powder.

Indium Shot:

- Is typically packaged in jars (according to weight) and backfilled with argon
- Should be stored in a dry environment at or below room temperature (a nitrogen dry box is ideal)
- Should be stored in containers that are purged with argon (after opening) and sealed tightly before returning to storage

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