

Lithium Aluminum Hydride:

A Versatile Reducing Reagent for Industrial Reductions

Li HYDRIDES

COMPARISON WITH OTHER COMPLEX HYDRIDES

- Highest active hydrogen content among common hydride reducing reagents
- Highest atom economy under all complex Al-hydrides
- Lowest amount of hydroxide precipitates upon work-up
- No toxic or gaseous by-products formed on hydrolysis

Hydride	Concentration [%]	Molecular weight [g/mol]	Reduction equivalents [mol/kg]	Hydroxide precipitate [kg/kmol H ⁺] ¹⁾	By-products ¹⁾
LiAlH ₄	> 97	37.95	102.2	25.4 LiAl(OH) ₄	None
LiBH ₄ in THF	10	21.78	18.4	21.45 LiB(OH) ₄	None
LiAlH ₄ in THF/Toluene	15	37.95	15.8	25.4 LiAl(OH) ₄	None
LiAlH ₄ in THF	10	37.95	10.5	25.4 LiAl(OH) ₄	None
NaAlH ₂ (OC ₂ H ₄ OCH ₃) ₂ in Toluene	70	202.16	6.9	59.0 NaAl(OH) ₄	76.1 kg methoxy ethanol (toxic!) 
AlH(<i>i</i> -Bu) ₂	97	142.21	6.8	118.0 NaAl(OH) ₄ or 78.0 Al(OH) ₃	116.2 kg (= 49600 L) <i>iso</i> -butane 

¹⁾ Referred to precipitate and by-product of 1 kmol hydride equivalent

PRODUCT PORTFOLIO

Lithium aluminum hydride LiAlH ₄ ; MW: 37.95 g/mol CAS: 16853-85-3	Availability	Conc. abt. [%]	Density abt. [g/mL] at 20 °C	Molarity abt. [mol/L]	Volume of Container / Typ. content of active product per container [kg]			
Solid	Crystalline Powder	> 97%			1 L	40 L	125 L	450 L
	Sieved Powder (< 1 mm)	> 97%			0.08	3.0	9.6	34.6
	Tablets (typ. 0.6 g) Diameter about 10 mm	> 97%			0.07	3.0	9.3	33.5
Solution	THF	10	0.90	2.4	0.12	4.6	14.5	52.2
	2-Methyl-THF	10	0.87	2.3	0.14	4.9	15.4	55.4
	THF/Toluene	15	0.89	3.5				
	Diethyl ether	20	0.76	4.0				
	Other solvents and concentrations available on request							

For solid materials, solvent-soluble bags (SecuBags®) are available in sizes ranging from 500 g to 5 kg. LAH solutions are offered in steel cylinders of 5 L, 40 L, 125 L and 450 L capacities. For smaller-scale needs, 1 L glass bottles are also available. Albemarle provides a compatible emptying system for use with the steel cylinders.



APPLICATIONS OF LITHIUM ALUMINUM HYDRIDE

Due to its strong reducing power, versatile properties and ready commercial availability, lithium aluminum hydride is often the reagent of choice for a wide range of chemical reductions across all scales. It has proven effective in several modern manufacturing processes for commercial active pharmaceutical ingredients. Typical transformations in both classical and contemporary chemical synthesis include, but are not limited to, the following examples:

General Reduction Types	Starting materials			$R-Hal$	$R-NO_2$	$R-C\equiv N$		$RCOO^-$	$RCOOH$	$RCOOR'$			
	Products		  	RH	RNH_2	RCH_2NH_2 $RCHO$	$RCH_2NR'_2$ $RCHO$	RCH_2OH	RCH_2OH	RCH_2OH		RCH_2OH $RCHO$	
$LiAlH_4$		+ -	- -	+ ²	+	+ ^{1,5} +	+ ^{1,5} +	+	+	+	+	- +	+
$LiAlH_4 - AlCl_3$ or $TiCl_4$		+ -	$\pm^4$ $\pm^4$	$\pm$	$\pm$	+	- +	+	+	+	+	- +	+ ³

1) inverse addition; 2) higher temp./reflux required; 3) Ar-ketones yield hydrocarbons;
4) Ti-catalysis required; 5) low temp. required;
+ = standard application / procedure
 $\pm$ = only with specific substrates and / or reaction conditions
- = no useful reaction

$R^* = R$ or H
 $R, R' =$ organic residues
 $Hal = Cl, Br, I$

IMPORTANT CHARACTERISTICS AT A GLANCE

Key Product Features

- Free of organic residues, resulting in high purity and excellent product yields.
- Enhanced safety: no toxic or gaseous by-products.
- Flexible formats: offered as solids (crystalline, powder and tablets) and solutions (THF, 2-Methyl-THF, THF/toluene mix and more).
- Custom packaging: broad range of sizes and customizable fill levels tailored to each customer's needs.

Industrial-Scale Safety & Compliance

- On-site technical support, audits and trainings to promote safe handling of our products.
 - Solvent soluble SecuBags® and ready-to-use cylinder system.
- Easy returns – Albemarle manages cylinders cleaning after use.
- Reliable global supply network and facilities in Germany, USA and Taiwan.



CONTACT AND INFORMATION

Albemarle is a global leader in transforming essential resources into critical ingredients for mobility, energy, connectivity and health. As a global specialty chemicals company, we empower small molecule API manufacturing by offering high-purity custom reagents and technical support to promote safe and compliant scale-up. Our unwavering commitment to consistent quality and reliable supply helps promote seamless operations for customers around the world.

As one of the world's largest suppliers of bromine and lithium products, Albemarle is vertically integrated—from resource extraction to tailored product development. This integration provides supply chain transparency and reinforces our mission to make a meaningful impact on people and the planet.

Learn more about our product portfolio and capabilities, and contact us at <http://www.albemarle.com/chemical-synthesis>

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