E-GRADE® AMINES

Huntsman is one of the world's largest producers of amine chemistries. Our **E-GRADE**[®] amines can be used in formulation of process materials for Semiconductor, Display and other electronics. Our broad product portfolio gives flexibility in expanding the options for any application.

PRODUCT OVERVIEW

Huntsman E-GRADE[®] amines are primarily used in stripping, cleaning, and wet etching formulations in the semiconductor, display, and PCB industries. Most are water soluble and contain aminoglycol or polyether structures where both the amine and glycol functions contribute to their performance. The range of primary, secondary, and tertiary amines and structures allows the selection of base strength and corrosion rates based on the needs of the application. **Huntsman** also offers purification services to assist in trace metal reduction for a broad range of amines including those not manufactured by **Huntsman**.

BENEFITS

- High purity
- Low trace metals
- Low vapor pressures
- Water soluble
- Trace metal reduction via purification
- Blending and aqueous dilution available
- Range of metal removal rates
- Range of pK_b and buffering abilities

PRODUCT GRADES

Grades	SEMI Standard	Typical PPB
E-GRADE®	VLSI	<20
E-GRADE [®] ULM	Grade 2	<10
E-GRADE® SLM	Grade 3	<2



Alkynolamines and Linear Amines	E-GRADE® MDEA	но		E-GRADE [®] PC			
	E-GRADE [®] MMEA	но	(0	E-GRADE [®] MEOX			
	E-GRADE® DMEA		nes Solvents	3-methyl-2-oxazolidinone			
	E-GRADE [®] DMEA 50	HO		E-GRADE [®] DMEU 1,3-dimethyl-2-imidazolidinone	~ <u>\</u> _		
les	E-GRADE® AEP			E-GRADE [®] MCH	\frown		
min	E-GRADE® APM	0 NH2					
Cyclic A	E-GRADE [®] HEM	одон		JEFFAMINE® M-Series (Mono)			
	E-GRADE [®] Morpholine	0 VII	erami	JEFFAMINE [®] D-Series (Di)	H ₂ N (NH ₂		
les	E-GRADE® EDA (n=0)		yeth		H_2N $(CH_2)n$ $(0$ (y) NH_2 H_2N $(0$ (y) NH_2 (z) (z)		
eamii	E-GRADE [®] DETA (n=1)	NH)	Pol	JEFFAMINE® T-Series (Tri)			
ylen	E-GRADE® TETA (n=2)	H ₂ N V ⁴ f NH ₂		E-GRADE [®] APMMEA			
Eth	E-GRADE® TEPA (n=3)		sic		но он		
Amine Oxides		Othe	E-GRADE [®] APDEA	H ₂ N N OH			
	E-GRADE [®] NMMO			E-GRADE® PMDETA			



HUNTSMAN

Enriching lives through innovation

E-GRADE® AMINES

HUNTSMAN

LINEAR POLARIZATION RESISTANCE CORROSION RATES FOR 10 WT% AQUEOUS AMINES



TYPICAL PHYSICAL PROPERTIES

Pro	ducts	Description	рК _ь	MW	Log P _{ow}	Amine Type	Vapor Pressure	BP (°C)	рН	Viscosity (cSt, 20°C)
	APM	Aminopropylmorpholine	4.0	144	-	1°/3°	0.06	224	11.9	6
iRADE®	DGA [™] Agent	2-(2-Aminoethoxy)ethanol	4.6	105	-1.89	1°	<0.01	221	11.8	54
	DMEA	Dimethylethanolamine	4.8	89	-0.55	3°	0.50	135	11.0	3
	MMEA	Monomethylethanolamine	4.2	75	2.31	2°	0.70	158	12.2	14
	MDEA	Methyldiethanolamine	5.4	119	-	3°	0.02	243	11.5	127
	APDEA	Aminopropyldiethanolamine	3.7	162	-1.74	1°/3°	<0.01	>360	12.0	117
	APMMEA	Aminopropylmonomethylethanolamine	3.8	132	-1.40	1°/3°	0.02	228	12.9	63
	AEP-HP	Aminoethylpiperazine	4.8	128	-1.48	1°/2°/3°	0.04	222	11.8	17
	PMDETA	Pentamethyldiethylenetriamine	5.1	173	-2.10	3°	0.20	202	11.9	2
Ч	HEM	Morpholinoethanol	7.1	131	-1.32	1°/3°	0.17	255	10.3	20
	Morpholine	Morpholine	5.4	87	-0.84	2°	9.80	129	11.0	2
	TEA 75%	75% Triethanolamine	-	149	-	3°	-	98	10.7	58
	EDA	Ethylenediamine	4.1	60	-1.60	1°	12.45	117	12.1	2
	DETA	Diethylenetriamine	4.2	103	-1.58	1°/2°	0.37	207	12.5	8
	TETA	Triethylenetramine	4.2	146	-2.65	1°/2°	<0.01	274	13.0	39
	TEPA	Tetraethylenepentamine	4.2	189	-3.16	1°/2°	<0.01	375	11.8	84
	NMMO 50%	N-Methylmorpholine Oxide	9.1	118	_	-	13.33	92	9.6	17

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TRACE METAL REDUCTION AND PURIFICATION CAPABILITIES



Huntsman Purification Testing to Support Customer R&D and Prototyping

> Develop purification options for experimental or new products

One Stop Shop

- > Access to Huntsman's full range of amines with purification
- > Transition from lab chemical supplier to high-capacity production

Scale up capabilities

- Technical Demo (<500 mL)</p>
- > LVM (1-2 drums)
- > HVM (>20 mT, bulk/drum)

• Purify and Blend as a service

- > Purify customer intermediates or raw materials
- > Toll blend customer specific mixtures
- > Dilution of high viscosity or materials at risk of freezing

For more information, contact your local Huntsman representative. www.huntsman.com / AdTech@huntsman.com

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250 Purifying Tech Grade

Initial Total Metals

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