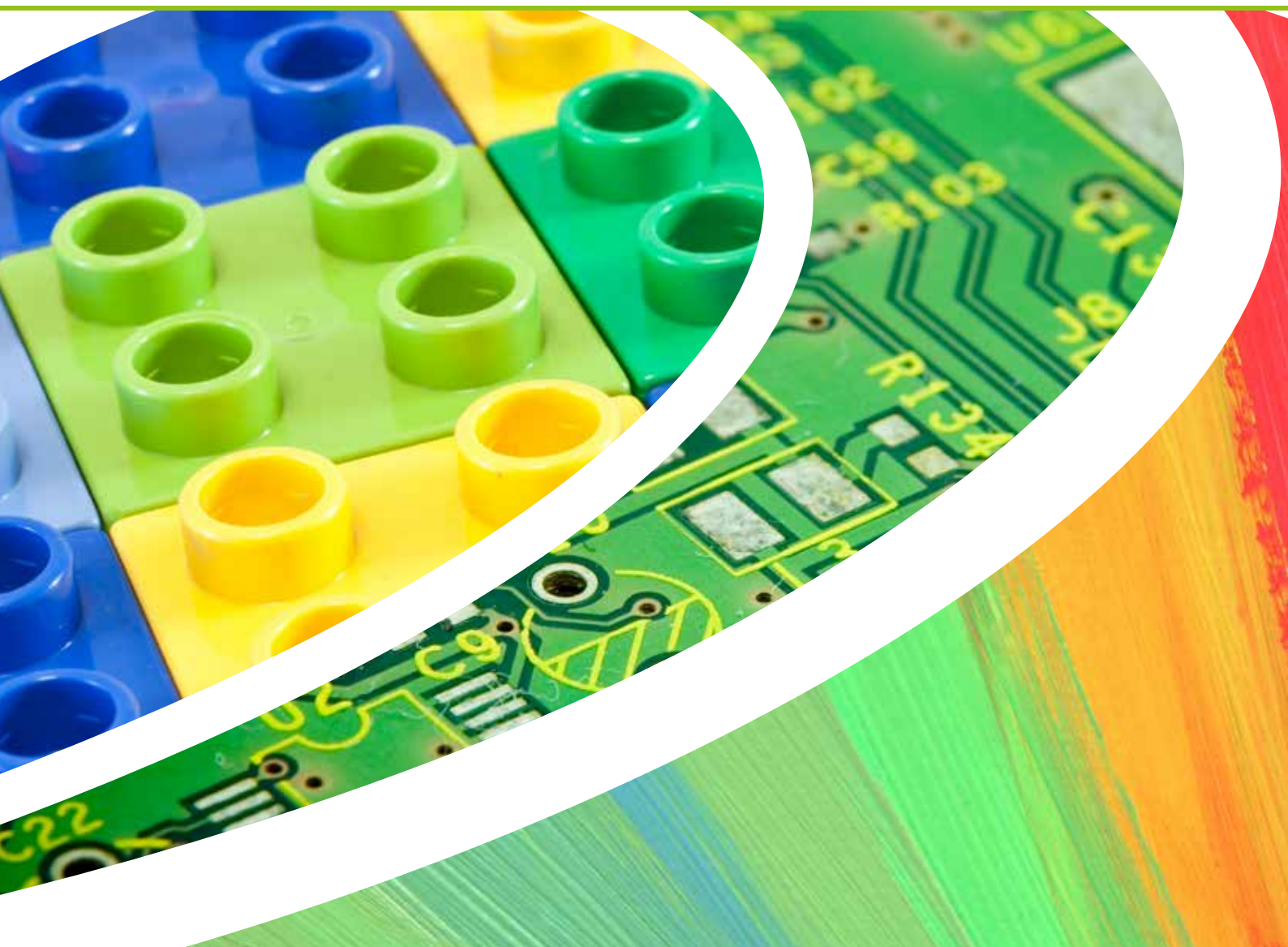




**UNITED INITIATORS**

*driving your success*



# Persulfates

Product Range  
Technical Information

# A LEADING PEROXIDE PRODUCER SERVING A GROWING WORLD

United Initiators (“UI”) is the largest, focused global producer of specialty chemical initiators. The company is the only global player providing a full range of both peroxodisulfates (“persulfates”) and organic peroxides.

We are a world leader in the manufacturing of persulfates and organic peroxides. Our network allows us to serve our customers both on a local and global scale. Supply reliability and quality are critical when it comes to persulfates and it is because of these key factors that customers choose United Initiators. Our products encompass a large range for the manufacturing of polymers and beyond. Applications include hair bleaching, disinfection, denture cleaning and tooth whitening. Further industrial applications include etching of printed circuit boards, chemical synthesis, oil & gas exploration, soil remediation and many more. Safety is a very crucial factor in our industry.

United Initiators applies highest possible safety standards in production and the entire supply chain. We offer to all of our customers in-depth service and training in order to handle our products in a safe and efficient manner. High environmental standards are a central focus within our daily global operations

## Locations

United Initiators is a global company with headquarters in Pullach/Germany and operations in various sites in North America, Asia and Australia.





United Initiators –  
sole fully integrated  
producer of organic  
peroxides  
and persulfates.

# PERSULFATE PRODUCT RANGE

Persulfates have the highest oxidation potential of all peroxygen compounds, which include permanganates. Due to these outstanding chemical properties, persulfates are the major initiator type for water-based polymerization and they are used in a large variety of applications beyond polymers. UI offers a diversified portfolio of persulfates for all standard applications and tailored products for the requirements of highly specialized industries.

## **Ammonium Persulfate APS – APS-3 – APS-5F**

Ammonium persulfate features the highest solubility of all industrially available peroxodisulfates. APS is used as an initiator (source of free radicals) for the polymerization of monomers and as a strong oxidizing agent in many applications. Stimulation of oil and gas wells, hair bleaching and paper treatment are just a few examples of these applications. APS has particular advantages of being safe, easy to handle and excellent storage stability as a result of its extremely high purity. Due to its hygroscopic character, pure APS is prone to clumping, particularly in humid atmosphere. Our APS derivatives APS-3 and APS-5F are supplied with a silica additive, minimizing the tendency of the material to agglomerate.



## Sodium Persulfate NPS

Sodium persulfate can also be used for polymerizations and hair bleaching but has an even wider range of applications, such as chemical etching. In addition to being easy to use and safe to handle, NPS has excellent storage stability and is almost non-hygroscopic. These characteristics are a direct result of the unique production process and extremely high purity. NPS can optionally be supplied with an addition of a silica additive for improved powder flow and reduced tendency to form agglomerates.

## Potassium Persulfate KPS – KPS-5

Potassium persulfate is a very pure, crystalline salt that is mainly used in applications which range from polymer manufacturing to paper treatment. KPS is the most robust of all the persulfate options and UI optionally also offers this material with a unique fine particle size. It is for this reason that KPS is the most popular reagent used worldwide in hair bleaching formulations. Even though the KPS salt is very stable, it still may absorb some moisture over time. UI also provides the KPS-5 variant, which contains a small amount of a silica additive. This addition of the silica effectively reduces the natural tendency of KPS to form clumps thus improving processability and powder flow.

## Potassium Monopersulfate CAROAT®

CAROAT® is based on the only stable transportable salt of peroxymonosulfuric acid (Caro's acid). It readily undergoes a strongly acidic reaction in aqueous solutions. As a result of its high oxidation potential and microbiological effectiveness, it can be used for a large number of different applications. It has the particular advantage of being highly stable in storage, easy and safe to handle, free from chlorine and features a high reactivity.

→ For more information please see our separate CAROAT® brochure.

### Typical Analytical Data of Persulfates

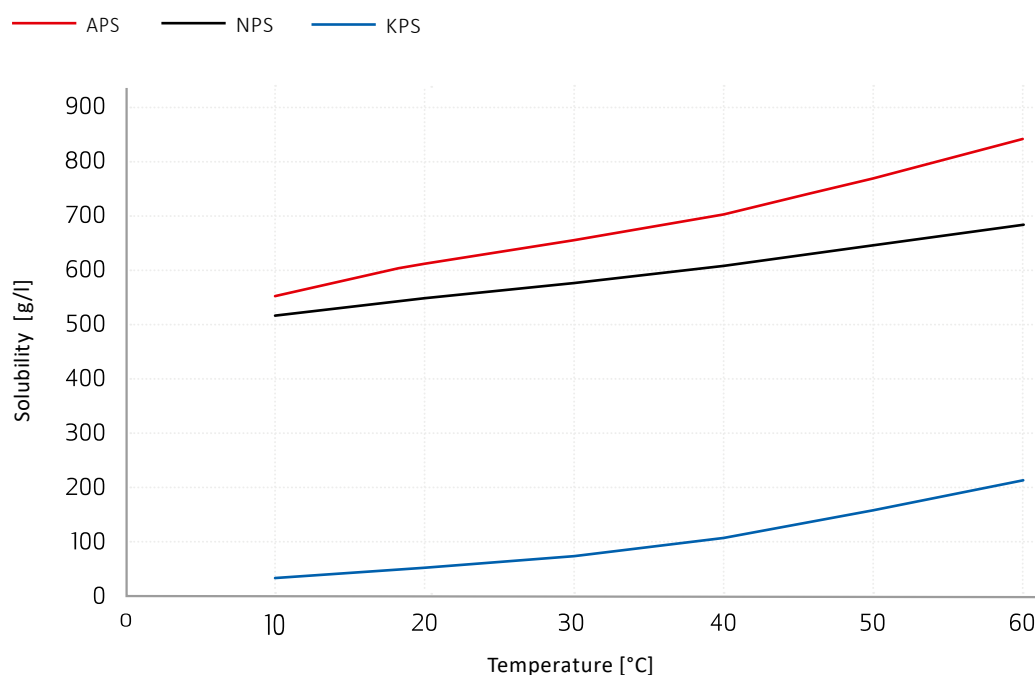
	Unit	APS Ammonium Persulfate	NPS Sodium Persulfate	KPS Potassium Persulfate	CAROAT® Potassium Monopersulfate	Comment <sup>1</sup>
Active Oxygen	%	> 6.94 / 7.00	> 6.65 / 6.70	> 5.86	> 4.5 / 4.7	S/T
Purity	%	> 99.0 / 99.9	> 99.0 / 99.9	> 99.0	N/A	S/T
Sulfuric Acid	%	< 0.1 / 0.05	< 0.1	< 0.15	N/A	S/T
Moisture	%	< 0.03	< 0.03	< 0.03	< 0.3	T
Bulk Density	g/cm <sup>3</sup>	1.10	1.25	1.10	1.10	T
Insolubles	ppm	< 16	< 10	< 20	< 10	T
pH (1% in water, 20 °C)		4.0	4.5	3.7	2.0	T
pH (10% in water, 20 °C)		3.1	3.5	-	1.6	T
Potassium (K)	ppm	< 10	< 10	-	-	T
Sodium (Na)	ppm	< 5	-	< 90	< 900	T
Copper (Cu)	ppm	< 0.1	< 0.1	< 0.1	< 0.1	T
Chloride (Cl)	ppm	< 3.0	< 3.0	< 3.0	N/A	T
Chromium (Cr)	ppm	< 0.8	< 0.8	< 0.8	< 0.3	T
Iron (Fe)	ppm	< 5 / 1	< 5 / 1	< 5 / 1	< 3	S/T
Manganese (Mn)	ppm	< 0.2	< 0.2	< 0.2	< 0.2	T
Zink (Zn)	ppm	< 2.0	< 2.0	< 2.0	< 2.0	T
SADT (dry state) <sup>2</sup>	°C	130	180	170	> 80	T
SADT (5 % moisture) <sup>2</sup>	°C	≤ 45	approx. 60	approx. 70	65 <sup>2</sup>	T

<sup>1</sup> S = technically specified; T = typical value

<sup>2</sup> Self-accelerating decomposition temperature; relates to a container size of one bag (25 kg, 55 lbs) only.  
Data for moist CAROAT® gained for a product moisture of 3.6 %.

## Solubility of persulfates as function of temperature

(Aqueous solutions)



### Particle Size

Sieve aperture		Passing [%]		
µm	mesh	APS <sup>1</sup>	NPS <sup>1</sup>	KPS <sup>2</sup>
2360	8	100	100	100
710	24	82	96	100
500	32	59	87	100
355	40	36	66	100
250	60	15	41	100
180	80	6	20	100
125	115	3	10	95
90	170	2	5	85

### Physical and Chemical Properties

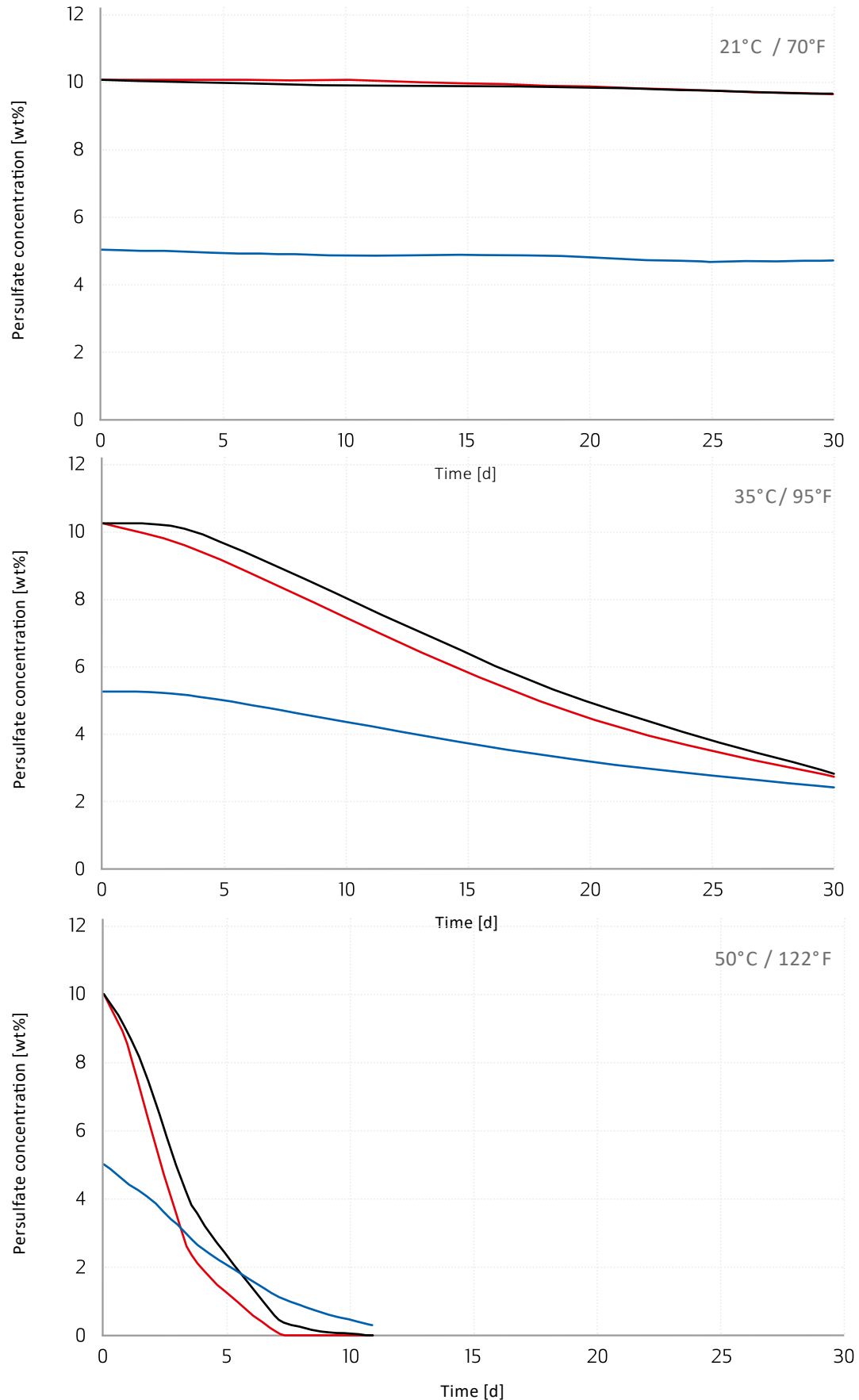
UI Product Name	Ammonium Persulfate APS	Sodium Persulfate NPS	Potassium Persulfate KPS
Chemical Name	Ammonium Peroxodisulfate	Sodium Peroxodisulfate	Potassium Peroxodisulfate
Chemical Formula	(NH <sub>4</sub> ) <sub>2</sub> S <sub>2</sub> O <sub>8</sub>	Na <sub>2</sub> S <sub>2</sub> O <sub>8</sub>	K <sub>2</sub> S <sub>2</sub> O <sub>8</sub>
Molecular Weight	228.2	238.1	270.1
Enthalpy Change of Solution [kJ/mol]	42.7	40.9	79.1
Crystal Density [g/cm <sup>3</sup> ]	1.98	2.48	2.59
Color	greyish/white	white	white
Odor	odorless	odorless	odorless

<sup>1</sup> Results of sieve analysis. <sup>2</sup> Results of light scattering test in presence of 0.5 % silica.  
Data applies for material from our Pullach site.

## Storage stability of aqueous persulfate solutions at different temperatures

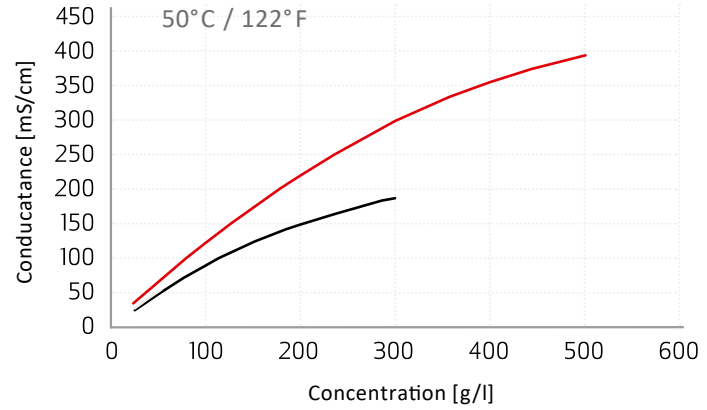
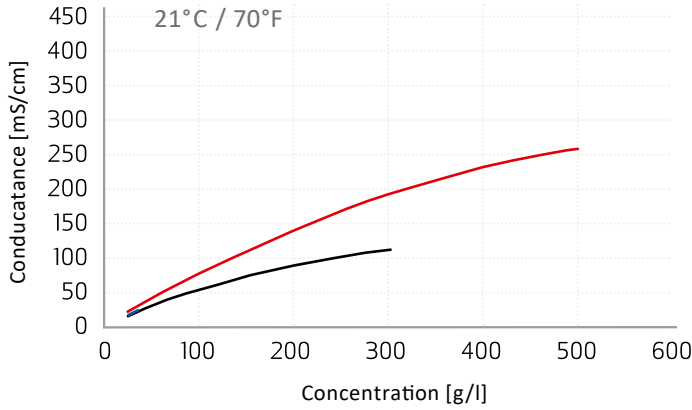
(10% for APS and NPS solutions, 5% for KPS, solution temperatures = 21, 35, 50 °C [70, 95, 122 °F], measured at own pH)

— APS 10%    — NPS 10%    — KPS 5%



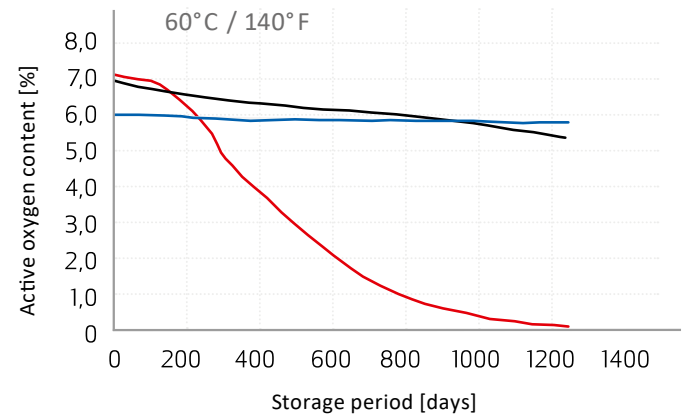
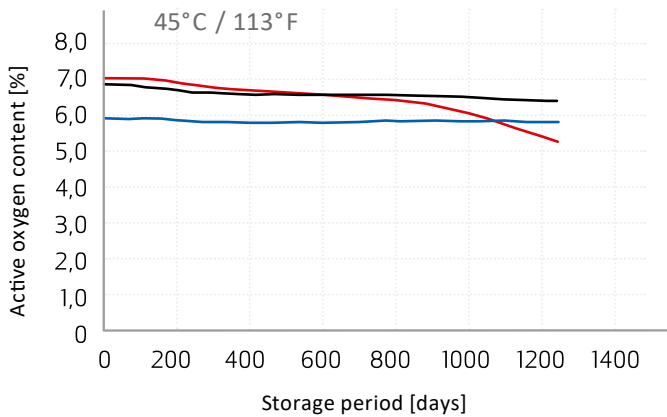
## Electrical conductance of aqueous persulfate solutions

— APS — NPS



## Decomposition of solid APS, NPS and KPS at dry storage conditions

— APS — NPS — KPS







We provide you  
a complete package of  
service and quality

**STANDARD PACKAGING**

Type	Material	Container wt	# of containers per pallet	Total product wt per pallet
Bag	PE	25 kg / 55 lbs	40	1000 kg / 2200 lbs
Supersack / Big Bag	PP sack w/ PE inliner	1000 kg / 2200 lbs	1	1000 kg / 2200 lbs

For information on alternative packaging options, please contact your sales representative at UI.

# SAFELY WORKING WITH PERSULFATES

When handled and stored properly, persulfates do not pose a threat to human health. Before working with a persulfate, please carefully study the appropriate SDS.

## Personal Protection

As persulfates are very strong oxidizers, certain precautions are necessary when working with this substance class. This starts with wearing suitable protective equipment such as protective goggles and appropriate protective gloves, but it is also advisable to wear protective full-length clothing such as a lab coat.



## Safe Handling

- Keep material away from sources of heat and direct sunlight
- Keep material away from combustible materials
- Protect from moisture, as SADT (self accelerated decomposition temperature) of persulfates will be significantly reduced, otherwise.
- Contaminants such as rust, dust and ash may also trigger decomposition and/or reduce SADT
- Product residues should be processed quickly and never be returned back into the storage container.
- Use tools of plastic, stainless steel when removing persulfates from containers. Always maintain a clean working environment.
- Do not breathe product, vapor or dust

## Dealing with Spillage

- Sweep up solid product and collect separately
- Collected residues need to be treated as special waste
- Avoid formation of dust
- Flush minor residues with ample amounts of water

## First Aid

- Eye contact  
Rinse immediately and thoroughly with water, minimum 15 minutes.  
Protect non-injured eye. Immediately consult a physician.
- Skin contact  
Immediately flush contaminated skin areas with plenty of soap and water  
Remove contaminated clothing immediately. If skin irritation persists, seek medical advice.
- Ingestion  
Rinse mouth and drink plenty of water (approx. two glasses). Do not induce vomiting.  
Consult a physician immediately.
- Inhalation  
Remove injured individual to fresh air. Consult a physician immediately.
- When consulting a physician  
Same treatment as for acid burns should be administered. Treatment for inhalation is the same as for irritating gases. Development of a late pulmonary edema may be possible.

## Storage

- Store separately from other dangerous and incompatible substances (e.g. aqueous liquids, redox-active chemicals)
- Store dry at temperatures preferably  $< 30\text{ }^{\circ}\text{C} / 86\text{ }^{\circ}\text{F}$  and in original sealed containers. Temperatures  $> 35\text{ }^{\circ}\text{C} / 95\text{ }^{\circ}\text{F}$  should be avoided in any case.
- Try to maintain a minimum distance of 20 – 30 cm / 1 ft. between pallets and/or bulk bags
- Do not stack pallets

## Storage Classes

- APS, NPS, KPS: Storage Class 5.1
- CAROAT®: Storage Class 8



# UNITED INITIATORS

*driving your success*



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