Dilactamate Katchem®
Dilactamate Katchem S®

Katchem spol. s r. o. • Ltd. • GmbH. • EST. 1990 Prague

Product Description

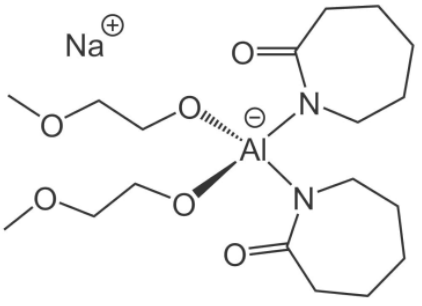
Introduction

Dilactamate Katchem® and Dilactamate Katchem S® are superior initiators for the anionic polymerization of caprolactam to PA-6.
Their main advantage over other catalysts such as sodium lactamate is very high tolerance to moisture, which allows reducing costs by using technical grade caprolactam and working without the protection of inert gas.
The resulting polymer shows increased toughness, resistance to low temperature and very low internal stress. The typical products are rods, plates, cylinders, gears, pulleys or semi-finished products such as insulated rail joints. High abrasion resistance makes PA-6 the material of choice for machinery parts in the mining industry and similar applications.

Dilactamate Katchem S® is a second generation initiator, which was developed especially for large castings, where the exothermic reaction and crystallization can cause local overheating and formation of inhomogeneities and bubbles. The special composition reduces the risk of overheating and leads to overall better homogeneity of the resulting polymer.
It uses the same dosage and handling as Dilactamate Katchem® and has no known disadvantages compared to this original, well established initiator.

Technical Specification

Chemical Composition:*
82 ± 2 % sodium dicaprolactamato-bis-(2-methoxyethoxy)aluminate
14 ± 3 % toluene
4 ± 3 % caprolactam



$Na[CH_3O(CH_2)_2O]_2[(CH_2)_5CON]_2Al$

Physical Properties:*

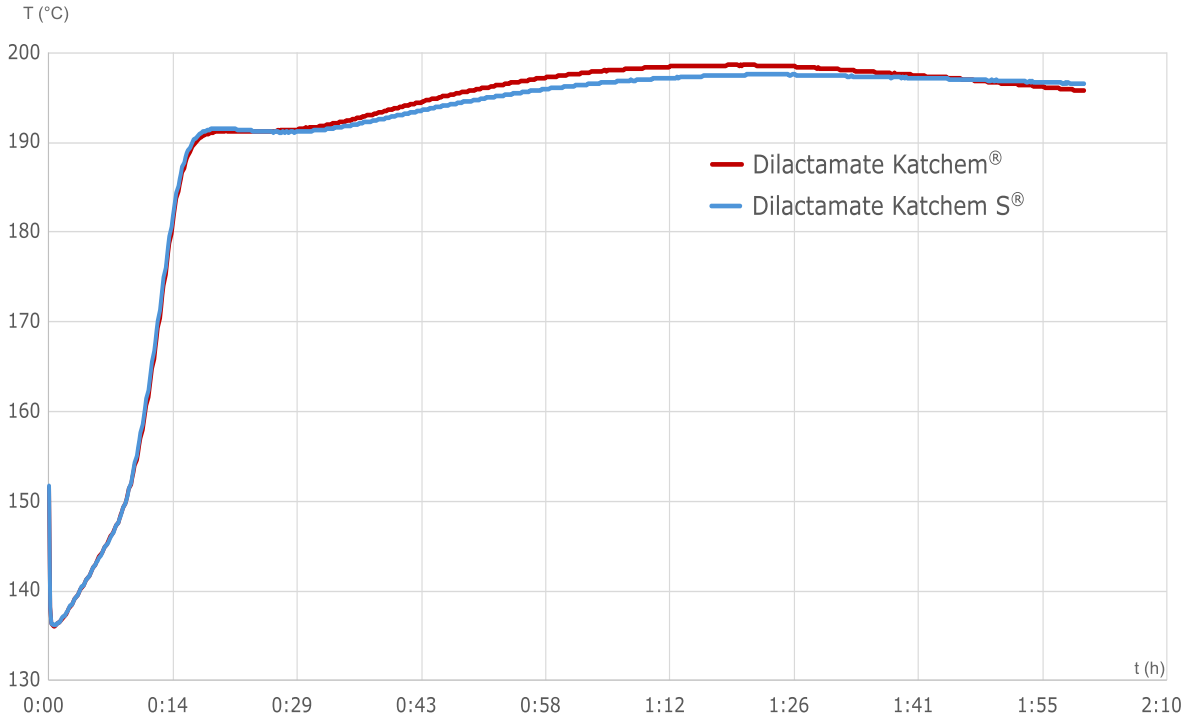
Appearance:	Pale-yellow viscous liquid
Viscosity at 20 °C:	1800 - 6000 mPa.s (cP)
Density:	1110 kg/m^3
Freezing point:	- 20 °C
Flash point:	22.5 °C
Decomposition temp.:	225 °C

*Applies to both Dilactamate Katchem® and Dilactamate Katchem S®. Dilactamate Katchem S® contains a small amount (< 1.0 %) of magnesium caprolactamate additive, which has no impact on physical properties, dosage or material handling.

Dilactamate Katchem S®

The anionic polymerization of caprolactam to PA-6 is an exothermic process with two main sources of heat. The first is the chemical reaction, in which the monomer units attach to each other, forming a polymer chain. The other is crystallization, in which the newly formed polymer changes its structure from amorphous to crystalline. The temperature profiles of these two processes always overlap and can never be completely separated. Their effect is added up and in certain cases, the resulting high temperature can cause problems such as inhomogeneities or excessive internal stress in the final plastic part. This is especially the case when using very large molds, where heat dissipation is slow and the process is close to adiabatic.
However, by using a suitable additive, it is possible to slightly slow down the crystallization, which results in a broader and lower temperature maximum:

Dilactamate Katchem® vs. Dilactamate Katchem S®

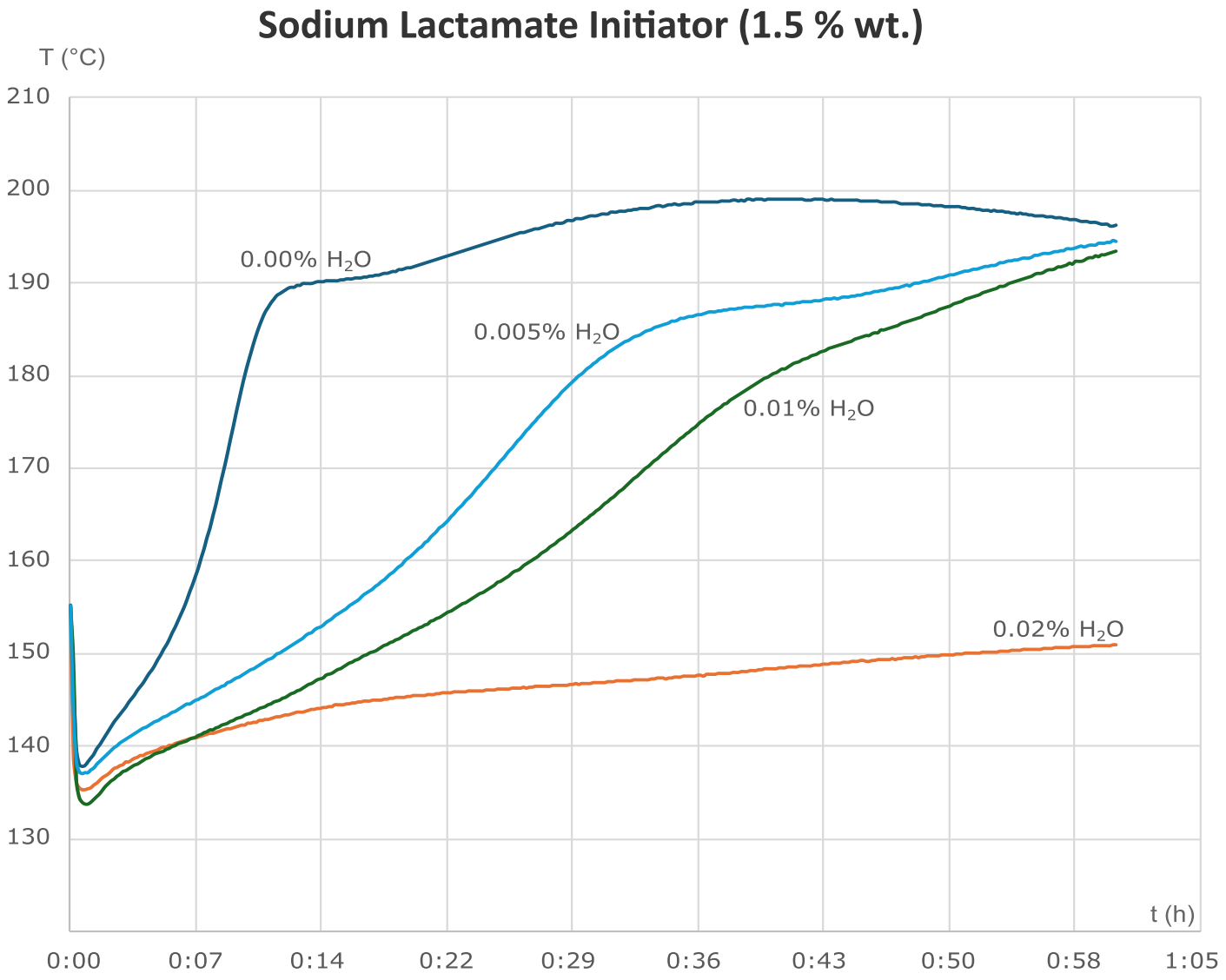


The experiments were performed with 1.0 kg caprolactam, 1 % wt. initiator, 0.5 % wt. activator (Brüggemann C20P). Temperature of the melt 136 °C, mold 156 °C.

The above results show that by using Dilactamate Katchem S®, the maximum temperature during polymerization can be effectively lowered by 1 - 2 °C even in small 1 kg samples. When casting larger amounts, this effect is expected to be much bigger.

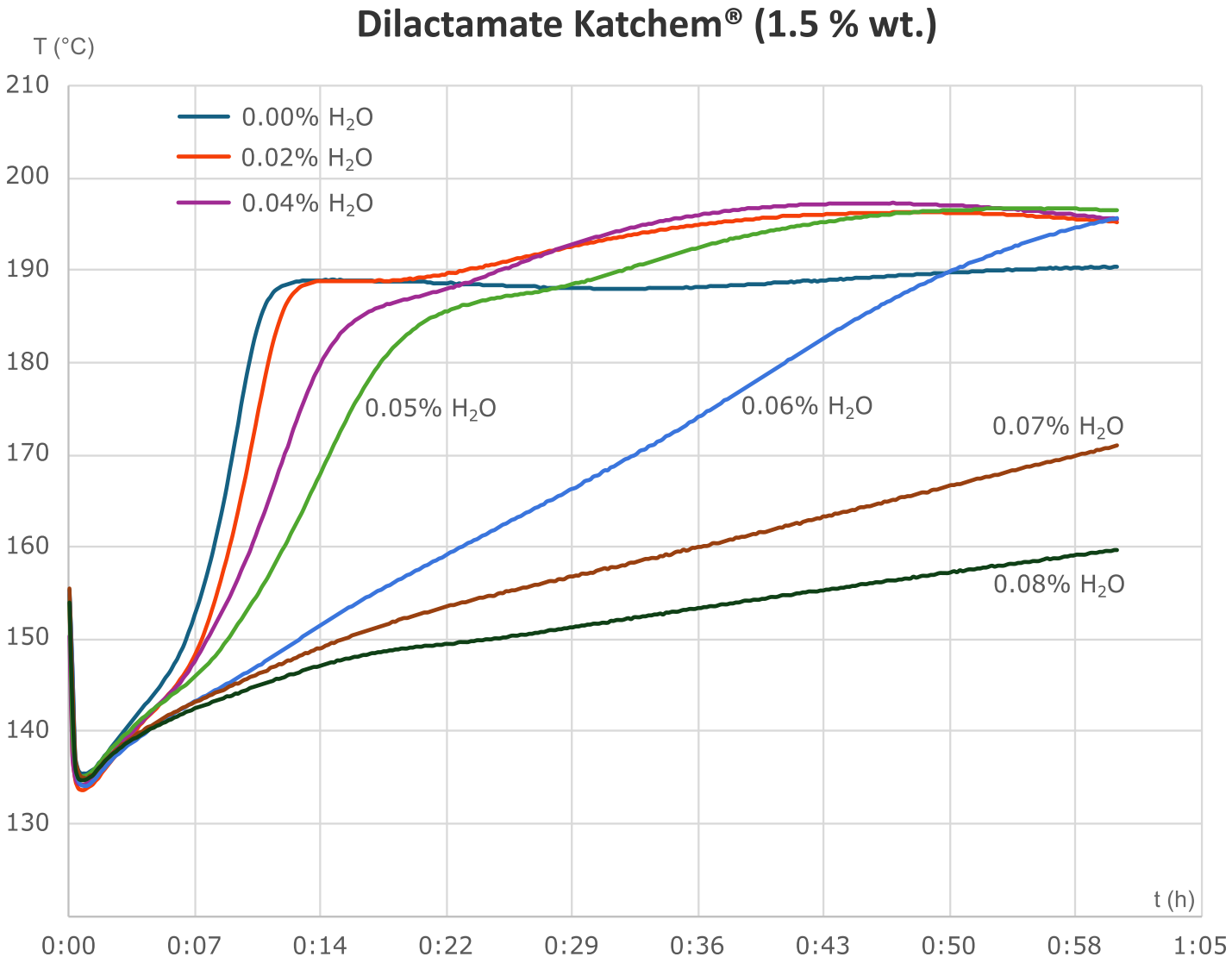
Resistance to Moisture

Water is known to efficiently block the catalytic activity of sodium caprolactamate based initiators. Humid air in the facility or sub-optimal raw material storage conditions is usually enough to cause difficulty in the technology of casting PA-6, leading to high percentage of defective parts.
Dilactamate Katchem® and Dilactamate Katchem S® initiators exhibit resistance to moisture up to 10 times higher than other commonly used initiators based on sodium caprolactamate.



The temperature curves (°C vs. time) show that when using a common sodium caprolactamate initiator, 0.005 % moisture in the monomer is enough to cause severe retardation, while 0.02 % water content leads to complete failure of the polymerization reaction.

With same dosage of Dilactamate Katchem®, the results are practically perfect with water content in the monomer up to 0.03 %. In the range 0.04 % - 0.05 % of water content, only slight retardation is observed, with acceptable quality of the product. As much as 0.06 % water needs to be artificially added into the monomer in the laboratory test to obtain similar result as was observed with 0.005 % water and standard, sodium caprolactamate based initiator. Thus, the water content in the monomer can be 10 times higher for same result.



*Experiments were performed using these conditions:

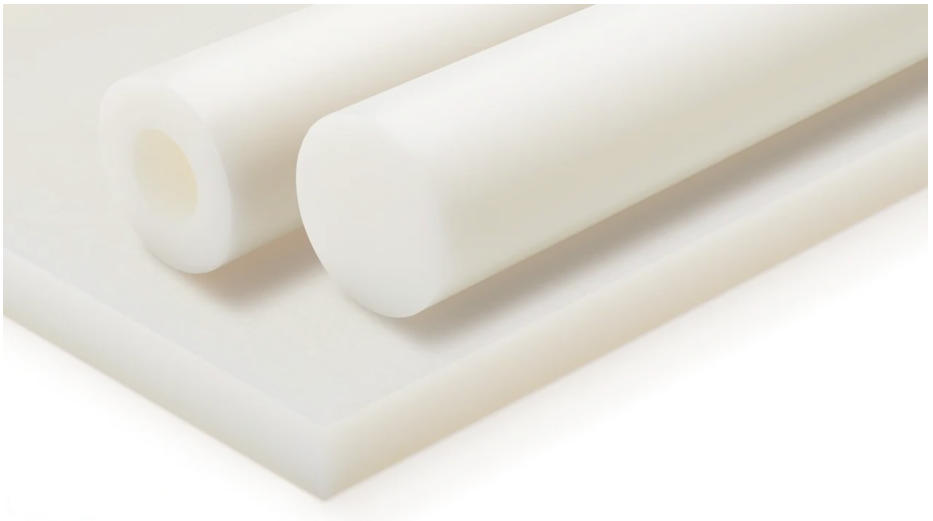
Freshly distilled caprolactam, total sample size 350 g, stainless steel cylindrical mold 70 mm diameter / 100 mm height, thermocouple in a thin glass tube submerged in the geometrical centre of the mold, temperature of the melt 135 °C, temperature of the mold/oven 156 °C, commercial sodium caprolactamate activator (c = 1.33 mmol/g of active substance in caprolactam), 0.5 % wt. of activator Brüggemann C20P.

Dosage

The recommended dosage of Dilactamate Katchem® or Dilactamate Katchem S® depends on the size and shape of the mold, as well as quality of caprolactam and air humidity. The following tables contains some typical values of initiator and activator dosages*, as well as recommended teperatures of the molds. The recommended temperature of the melt is 135 °C.

Rods Diameter	Initiator	Activator	Mold Temp.	Time
20 - 29 mm	1.56 %	0.70 %	150 - 152 °C	40 min
30 - 39 mm	1.40 %	0.54 %	153 - 155 °C	40 min
40 - 59 mm	1.30 %	0.45 %	156 - 158 °C	60 min
60 - 80 mm	1.12 %	0.30 %	160 - 163 °C	90 min
81+ mm	1.12 %	0.20 %	161 - 165 °C	100 min

Plate Thickness	Initiator	Activator	Mold Temp.	Time
8 - 14 mm	1.10 %	0.32 %	160 - 162 °C	90 min
15 - 34 mm	1.10 %	0.30 %	163 - 170 °C	100 min
35 - 79 mm	1.10 %	0.29 %	163 - 170 °C	120 min
80+ mm	1.10 %	0.28 %	163 - 170 °C	120 min



*All percentages are by weight. The activator used in the examples is a solution of hexamethylene diisocyanate in organic solvents, containing 16 % NCO groups (commercial name "Telhard PUR"). For other activators, the percentage needs to be recalculated depending on NCO groups content.

Please note that the listed values were tested on a particular equipment and are not guaranteed to work flawlessly under every circumstances. Always optimize the amounts for your specific casting conditions.

Customer Support

Our R&D department is ready to help the customers solve any practical problems or difficulties with polyamide casting. Custom research in our well equipped laboratories is possible upon request.

Shipping and Handling

We ship worldwide. The standard packaging of our initiators is 50 kg in 60-liter steel drums (384 mm dia., 595 mm height), up to 6 drums (300 kg netto) fit on one wooden pallet (120 x 80 cm). We usually ship within one week after obtaining a binding order. Dilactamate Katchem® and Dilactamate Katchem S® are flammable liquids and are considered dangerous goods in quantity bigger than 350 kg, according to ADR.

About Us

Katchem spol. s r. o. was established in 1990 as a spin-off from the Czech Academy of Sciences. It is a modern, innovative company with great research potential. We have successfully completed dozens of joint research projects with a range of research institutions and private companies in our 35 years history on the market. Our expert team is experienced and highly capable. We research and develop world-class production technologies in the field of special chemical compounds.

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