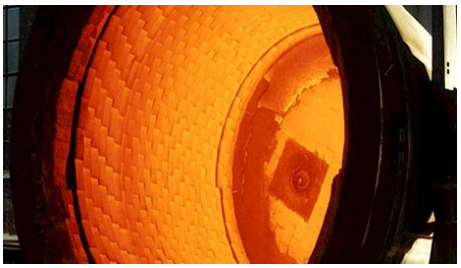
REFRACTORIES

Introduction



Silmaco has been actively operating in the world of silicate for more than 25 years. As a small family-run business, nowadays our company supplies in at least 50 countries worldwide.
We aim to achieve a close relationship with our customers and make every effort to give our clients a quick and appropriate response to their questions, problems or requests. This results in a **continuous expansion** of our **product portfolio** and the development of **tailor made solutions**. In this way, we have turned our small size into our biggest asset and are known as a particularly innovative and flexible player in the silicate industry. Silmaco produces a **wide range** of high quality l**iquid** and **granular soluble silicates** especially designed for the **refractory industry**.

Liquids

Sodium silicates

Silmaco produces liquid sodium silicates in a variety of SiO_2/Na_2O molar ratios ranging from 1,65 (highly alkaline) to 3,45 (highly siliceous). We are able to adjust the molar ratio and concentration (%dry matter) depending on your needs. Typical grades used for refractory applications are shown in the Table 1.

Table 1: *Typical liquid Sodium Silicates used for Refractory Applications*

Grade	Molar Ratio	Weight Ratio	%Dry matter	Density (g/cm3)
165-5052	1,65	1,55	45,0	1,55
200-5052	2,00	1,90	45,5	1,55
210-4950	2,10	2,00	44,2	1,53
220-5455	2,20	2,10	49,5	1,61
260-5051	2,60	2,50	46,7	1,54
340-3738	3,40	3,30	35,0	1,35
340-3840	3,40	3,30	36,5	1,37

Lithium silicates

Silmaco possess a broad portfolio of lithium silicate solutions with molar ratio's SiO_2/Li_2O ranging from 2,95 to 5,80. Lithium silicates are **high ratio**, **low viscosity** solutions that can be used as an inorganic binder. The **binding** and **refractory properties** of potassium- and sodium silicates can also be **improved by mixing** them with **lithium silicates**.

Table 2: *Lithium Silicates especially developed for Refractory Applications*

Grade	Molar Ratio	Weight Ratio	%Dry matter	Density (g/cm3)
SILL440	4,40	8,80	25	1,20
SILL580	5,80	11,60	20	1,15

Mixtures

A dedicated team of technical experts is at your service to prepare tailor-made silicate based mixtures in our special designed mixing division.

We dispose of vessels of different sizes and are able to prepare batches ranging from 1.000 towards 25.000L.

Solids

SILMACO produces solid silicates of three different SiO_2/Na_2O ratio's. All of them can be used in refractories.

Sodium metasilicates have a ratio of 1 and are the most alkaline. Silmaco produces sodium metasilicate **anhydrous, -pentahydrate and -nonahydrate**. As shown in Table 3, these grades differ in terms of degree of hydration and a variety of grain sizes are available.

Silmaco's metasilicates are characterized by a **high bulk density** and a **low dust content** and, as is illustrated in Figure 1, **dissolves very easily**, even in cold water. Our **nonahydrate**, with his high water content (54%) and low melting point (48°C), is especially useful in **self flowing hot repair mixes**. Whereas **anhydrous sodium metasilicate** is mainly used as an **accelerator** for chemical bonded mixes.

Sodium disilicate and **-trisilicate** have a ratio of 2,0 and 3,4, respectively. We produce them in hydrated form in order to be soluble at room temperature. To improve the speed of dissolution the granules are grinded towards powders. The higher ratio give them more binding capacity compared to sodium metasilicates. They are for example used as a part of the binder system in **wet spray mixtures**.

Table 3: *An overview of SILMACO's Solid Sodium Silicates*

Type		Molar Ratio	Concentration (%)	Bulk density (g/L)	Melting point (°C)	Grade	Particle size distribution (micron)	Dissolving speed[§](s)
Sodium Metasilicate	**Anhydrous**	0,96	97	1.100	1089	M0FA	200 - 630	100
						M0FB	630 - 1250	110
	Pentahydrate	1,03	57	950	72	M5Fine	200 - 1250	90
						M5Medium	200 - 1600	100
	Nonahydrate	1,04	46	850	48	M9Standard	200 - 1600	80
Sodium Disilicate		2,00	82	875		200P1	d_{50} = 100	180
						200FA	200 – 630	300
Sodium Trisilicate		3,40	83	875		340P1	d_{50} = 70	360
						340P2	d_{50} = 170	360

(§) Dissolving speed when preparing a 5w% solution at room temperature

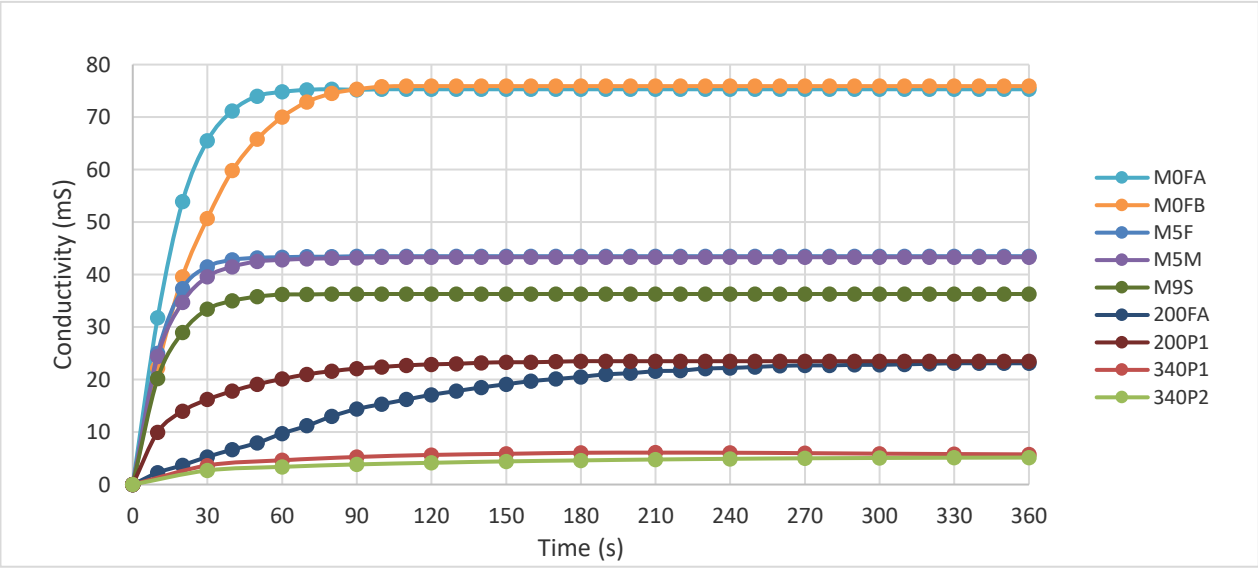


Figure 1: *Dissolving speed of SILMACO's Solid Sodium Silicates*

Packaging and Storage

Liquid silicates are sold in 200L drums (plastic or steel), 1000 L IBC or bulk. For storage no aluminium, light alloy, galvanized steel and glass receptacles or pipes should be used. On contact with aluminium or light alloys hydrogen gas may be evolved. Steel, stainless steel and alkali stable plastics (e.g. HDPE) are generally appropriate. All liquid solutions should be protected against freezing.

Granular sodium silicates are available in bags of 25 kg, bigbags or bulk. They should be kept in a dry storage because of their affinity for moisture.

Safety

The risk of soluble silicates is strongly dependent on the ratio SiO_2/Na_2O and concentration, as this controls the degree of alkalinity of the individual products. Specific **Material Safety Data Sheets** should always be consulted.

All the soluble silicates, even those that are not classified as Dangerous Subsances, are alkaline chemicals. Therefore contact with eyes, skin and clothes should be avoided. Sodium Metasilicates are strongly alkaline products and therefore classified as dangerous goods. They should be handled with care in order to prevent injuries. Whenever sodium metasilicate as a substance on its own or in a preparation is handled outside closed systems, **suitable personal protective equipment** (gloves, goggles, dust masks or respirators) is the preferred and only measure of control.

Environment

Because of its inorganic character, soluble silicates **do not significantly influence the natural cycles**. After being used, they mostly occur in a highly diluted liquid form and do not have a relevant influence on the environment. Only concentrated solutions may cause adverse effects on aquatic biosystems. Therefore neutralisation should be carried out before discharging to water / effluent systems. The silica ending up in the environment will be absorbed in the natural cycles of this material and **recycle itself**.