

<b>ROBATEL</b>	Technical note	<i>File</i>	<i>Document</i>	<i>Seq</i>	<i>Rev.</i>	<i>Page</i>
	<b>Compound No. 9™</b>	N MAT	NTE 09	DCA	0	1/3

File : Materials  
**Neutron and thermal shielding**

## SUMMARY

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Cancels and replaces note N MAT NTE DC 09A rev. 3

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## 1. PURPOSE

This technical note gives the general characteristics of ROBATEL neutron absorbing material called "compound No. 9".

## 2. USE

This neutron absorbing material can be used for any shielding not subject to special thermal or mechanical strains. If possible, it has to be poured into metallic casings, tightly closed in order to keep its best efficiency (under normal conditions). The pouring aperture must be as large as possible.

If there is no metallic casing, one must take into consideration the decreasing quantity of free water by drying. The third composition in § 3 corresponds to a material heated at 110° C in a non-tight casing.

This material has been tested by irradiation up to an integrated flux of  $1.8 \cdot 10^{17}$  thermal neutron/cm<sup>2</sup>. No apparent damage has been noted except for a graduation of color.

## 3. CHEMICAL COMPONENTS (elementary composition)

**Normal conditions** : density = 1.20 kg/dm<sup>3</sup>

Elements	% mass	g/cm <sup>3</sup>	10 <sup>24</sup> atoms/cm <sup>3</sup>
Boron	0.97	1.163 10 <sup>-2</sup>	6.473 10 <sup>-4</sup>
Calcium	9.82	1.178 10 <sup>-1</sup>	1.769 10 <sup>-3</sup>
Carbon	35.10	4.212 10 <sup>-1</sup>	2.111 10 <sup>-2</sup>
Hydrogen	8.52	1.023 10 <sup>-1</sup>	6.096 10 <sup>-2</sup>
Oxygen	37.64	4.517 10 <sup>-1</sup>	1.699 10 <sup>-2</sup>
Sulfur	6.85	8.217 10 <sup>-2</sup>	1.542 10 <sup>-3</sup>
Miscellaneous	1.11	1.330 10 <sup>-2</sup>	0

**After drying** : density = 1.03 kg/dm<sup>3</sup>

Elements	% mass	g/cm <sup>3</sup>	10 <sup>24</sup> atoms/cm <sup>3</sup>
Boron	1.13	1.163 10 <sup>-2</sup>	6.473 10 <sup>-4</sup>
Calcium	11.45	1.178 10 <sup>-1</sup>	1.769 10 <sup>-3</sup>
Carbon	40.92	4.212 10 <sup>-1</sup>	2.111 10 <sup>-2</sup>
Hydrogen	8.08	8.314 10 <sup>-2</sup>	4.955 10 <sup>-2</sup>
Oxygen	29.15	3.001 10 <sup>-1</sup>	1.129 10 <sup>-2</sup>
Sulfur	7.98	8.217 10 <sup>-2</sup>	1.542 10 <sup>-3</sup>
Miscellaneous	1.29	1.330 10 <sup>-2</sup>	0

**After heating** : density = 0.96 kg/dm<sup>3</sup>

Elements	% mass	g/cm <sup>3</sup>	10 <sup>24</sup> atoms/cm <sup>3</sup>
Boron	1.21	1.163 10 <sup>-2</sup>	6.473 10 <sup>-4</sup>
Calcium	12.27	1.178 10 <sup>-1</sup>	1.769 10 <sup>-3</sup>
Carbon	43.87	4.212 10 <sup>-1</sup>	2.111 10 <sup>-2</sup>
Hydrogen	7.85	7.537 10 <sup>-2</sup>	4.493 10 <sup>-2</sup>
Oxygen	24.85	2.386 10 <sup>-1</sup>	8.976 10 <sup>-3</sup>
Sulfur	8.56	8.217 10 <sup>-2</sup>	1.542 10 <sup>-3</sup>
Miscellaneous	1.39	1.330 10 <sup>-2</sup>	0

#### 4. **PHYSICAL CHARACTERISTICS**

Density (wet)	1.20 to 1.25	Kg/dm <sup>3</sup>
Thermal conductivity coefficient : wet	0.5	W/m °C
dry	0.3	W/m °C
Volumic heat (wet)	2,483	kJ/m <sup>3</sup> °C
Heat of dehydration between 100 and 130° C	20,725	kJ/m <sup>3</sup> °C
Heat of dehydration between 130 and 180° C	2,805	kJ/m <sup>3</sup> °C
Volumic heat after dehydration	1,458	kJ/m <sup>3</sup> °C
Thermal expansion coefficient	11 10 <sup>-5</sup>	
Limit temperature	70	°C
Heat power during fire	23,100	MJ/m <sup>3</sup>

#### 5. **MECHANICAL CHARACTERISTICS**

Mechanical strength (rupture) :

- compression	4.5	MPa
- tension	1	MPa
- dynamic elastic module	2,000	MPa.