

<b>ROBATEL</b>	Technical note	<i>File</i>	<i>Document</i>	<i>Seq</i>	<i>Rev.</i>	<i>Page</i>
	<b>Compound No. 10™</b>	N MAT	NTE 10	DCA	0	1/3

File : Materials  
**Neutron and thermal shielding**

## SUMMARY

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Rev.	Redaction	Verification	Approval
			Date

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## 1. PURPOSE

This technical note gives the general characteristics of ROBATEL neutron absorbing material called "compound No. 10".

## 2. USE

This material is derived from compound No. 9. It can be used for shielding subject to low thermal strains. In that case, 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 = 1.15 kg/dm<sup>3</sup>

Elements	% mass	g/cm <sup>3</sup>	10 <sup>24</sup> atoms/cm <sup>3</sup>
Boron	0.97	$1.115 \cdot 10^{-2}$	$6.204 \cdot 10^{-4}$
Calcium	10.09	$1.161 \cdot 10^{-1}$	$1.743 \cdot 10^{-3}$
Carbon	34.24	$3.938 \cdot 10^{-1}$	$1.974 \cdot 10^{-2}$
Hydrogen	8.39	$9.644 \cdot 10^{-2}$	$5.748 \cdot 10^{-2}$
Oxygen	38.13	$4.385 \cdot 10^{-1}$	$1.650 \cdot 10^{-2}$
Sulfur	7.07	$8.128 \cdot 10^{-2}$	$1.526 \cdot 10^{-3}$
Miscellaneous	1.11	$1.275 \cdot 10^{-2}$	0

**After drying** : density = 0.99 kg/dm<sup>3</sup>

Elements	% mass	g/cm <sup>3</sup>	10 <sup>24</sup> atoms/cm <sup>3</sup>
Boron	1.13	$1.115 \cdot 10^{-2}$	$6.204 \cdot 10^{-4}$
Calcium	11.74	$1.161 \cdot 10^{-1}$	$1.743 \cdot 10^{-3}$
Carbon	39.83	$3.938 \cdot 10^{-1}$	$1.974 \cdot 10^{-2}$
Hydrogen	7.92	$7.834 \cdot 10^{-2}$	$4.669 \cdot 10^{-2}$
Oxygen	29.86	$2.952 \cdot 10^{-1}$	$1.111 \cdot 10^{-2}$
Sulfur	8.22	$8.128 \cdot 10^{-2}$	$1.526 \cdot 10^{-3}$
Miscellaneous	1.29	$1.275 \cdot 10^{-2}$	0

After heating : density = 0.92 kg/dm<sup>3</sup>

Elements	% mass	g/cm <sup>3</sup>	10 <sup>24</sup> atoms/cm <sup>3</sup>
Boron	1.21	1.115 10 <sup>-2</sup>	6.204 10 <sup>-4</sup>
Calcium	12.62	1.161 10 <sup>-1</sup>	1.743 10 <sup>-3</sup>
Carbon	42.80	3.938 10 <sup>-1</sup>	1.974 10 <sup>-2</sup>
Hydrogen	7.68	7.066 10 <sup>-2</sup>	4.212 10 <sup>-2</sup>
Oxygen	25.47	2.343 10 <sup>-1</sup>	8.817 10 <sup>-3</sup>
Sulfur	8.84	8.128 10 <sup>-2</sup>	1.526 10 <sup>-3</sup>
Miscellaneous	1.39	1.275 10 <sup>-2</sup>	0

#### 4. PHYSICAL CHARACTERISTICS

Density (wet)	1.15 to 1.20	Kg/dm <sup>3</sup>
Thermal conductivity coefficient : wet	0.5	W/m °C
dry	0.3	W/m °C
Volumic heat (wet)	2,186	kJ/m <sup>3</sup> °C
Heat of dehydration between 100 and 130° C	19,734	kJ/m <sup>3</sup> °C
Heat of dehydration between 130 and 180° C	2,535	kJ/m <sup>3</sup> °C
Volumic heat after dehydration	1,203	kJ/m <sup>3</sup> °C
Thermal expansion coefficient	8 10 <sup>-5</sup>	
Limit temperature	100	°C
Heat power during fire	21,600	MJ/m <sup>3</sup>

#### 5. MECHANICAL CHARACTERISTICS

Mechanical strength (rupture) :

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