



1918

**TALLINNA TEHNIKAÜLIKOOL**  
TALLINN UNIVERSITY OF TECHNOLOGY

CENTRE FOR MATERIALS RESEARCH

**5 Ehitajate tee, 19086 Tallinn; phone 620 3150; fax 620 3153**

Reg .No.: 74000323

*Date 29.06.2016*

**CERTIFICATE OF THE ANALYSIS No 29.06.2016/RT1**

*XRD analysis of a TRILITE RMS board*

**CUSTOMER: Triple Lite Incorporated**

**CONTACTPERSON** : Julie Huang, e-mail: triple.lite@msa.hinet.net

**ORDER:** Identify the composition of the sample.

**DESCRIPTION OF THE SAMPLES:** Board, with dimensions of 100×145 mm.

**ANALYSIS METHODS:** Part of the sample was ground and analyzed by X-Ray diffractometer Bruker AXS D5005 with Cu tube ( $\lambda - 1.542\text{\AA}$ ). The measuring range (2Theta) was 10.4-75°, step size was 0.04°, the measuring time on the one step was 6 s. Copper tube operating at 40 kV and 40 mA. Variable slit V12 was used. EDS (Energy Dispersive Spectroscopy, INCA Energy 350 was used) analysis of RMS samples was performed to specify the data. Obtained data was analysed by International Centre for Diffraction Data (ICDD) PDF-4 + 2014 database.

**RESULTS:** EDS (Energy Dispersive Spectroscopy) analysis indicated that the sample contains the following elements: Mg, Ca, K, Al, Si, C, O and S. The XRD analysis indicates that the boards consist of the following substances: Approximately 60% of the analysed samples consist of five compounds - the Diopside [ $\text{CaMgSi}_2\text{O}_6$ ], Muscovite [ $\text{KAl}_2(\text{Si,Al})_4\text{O}_{10}(\text{OH})_2$ ], Brucite [ $\text{Mg}(\text{OH})_2$ ], Spinel [ $\text{MgAl}_2\text{O}_4$ ], Silicon Oxide [ $\text{SiO}_2$ ]. Sulfur compounds not detected by XRD. Sulfur forms amorphous compounds.

Detailed composition is given in the Table 1.

Table 2 shows the elemental composition, calculated from the compounds.

***This certificate of the analysis is to be reprinted as a whole. For the partial reprinting the written permission from the Centre for Materials Research should be inquired.***

			TRILITE
Table 1 Results of the calculation of the concentration (weight %)			RMS
PDF no.	Compound name	Formula	Concentrations
01-086-2334	Calcite	Ca(CO <sub>3</sub> )	4.2%
04-009-8366	grossular	Ca <sub>3</sub> Al <sub>2</sub> (SiO <sub>4</sub> ) <sub>3</sub>	3.5%
01-074-1091	Yugawaralite	CaAl <sub>2</sub> Si <sub>6</sub> O <sub>16</sub> (H <sub>2</sub> O) <sub>4</sub>	0.8%
01-074-0836	Clintonite-1M	CaMg <sub>2</sub> Al(Al <sub>3</sub> Si)O <sub>10</sub> (OH) <sub>2</sub>	4.8%
04-013-2114	Diopside; syn	CaMgSi <sub>2</sub> O <sub>6</sub>	5.0%
04-011-9020	Lime; syn	CaO	2.3%
00-048-0900	Potassium Magnesium Silicate	K <sub>2</sub> MgSiO <sub>4</sub>	6.3%
00-058-2034	Muscovite-2M1	KAl <sub>2</sub> (Si,Al) <sub>4</sub> O <sub>10</sub> (OH) <sub>2</sub>	12.0%
01-086-2344	Magnesite	Mg(CO <sub>3</sub> )	1.9%
04-013-9511	brucite; Brucite; syn	Mg(OH) <sub>2</sub>	22.9%
04-009-7699	spinel; syn	Mg <sub>0.389</sub> Al <sub>2.407</sub> O <sub>4</sub>	1.9%
04-008-8613	spinel; syn	MgAl <sub>2</sub> O <sub>4</sub>	11.9%
04-001-7850	Forsterite; syn	Mg <sub>2</sub> (SiO <sub>4</sub> )	6.2%
01-082-1838	Lizardite-1T	Mg <sub>3</sub> (Si <sub>2</sub> O <sub>5</sub> )(OH) <sub>4</sub>	2.7%
00-013-0558	Talc-2M	Mg <sub>3</sub> Si <sub>4</sub> O <sub>10</sub> (OH) <sub>2</sub>	0.3%
01-073-6375	Magnesium Aluminum Oxide	MgAl <sub>2</sub> 6O <sub>40</sub>	4.1%
01-073-3469	Silicon Oxide	SiO <sub>2</sub>	8.6%
04-006-0514	Cristobalite; syn	SiO <sub>2</sub>	0.7%

PDF – Database Powder Diffraction File no.;

Syn. - synthetic

Table 2. The concentrations of the chemical elements, calculated according to the compounds.

		TRILITE
		RMS
Element	Concentrations	
H	0.9%	
C	0.8%	
O	48.0%	
Mg	17.1%	
Al	12.5%	
Si	11.3%	
K	3.7%	
Ca	5.7%	

***This certificate of the analysis is to be reprinted as a whole. For the partial reprinting the written permission from the Centre for Materials Research should be inquired.***

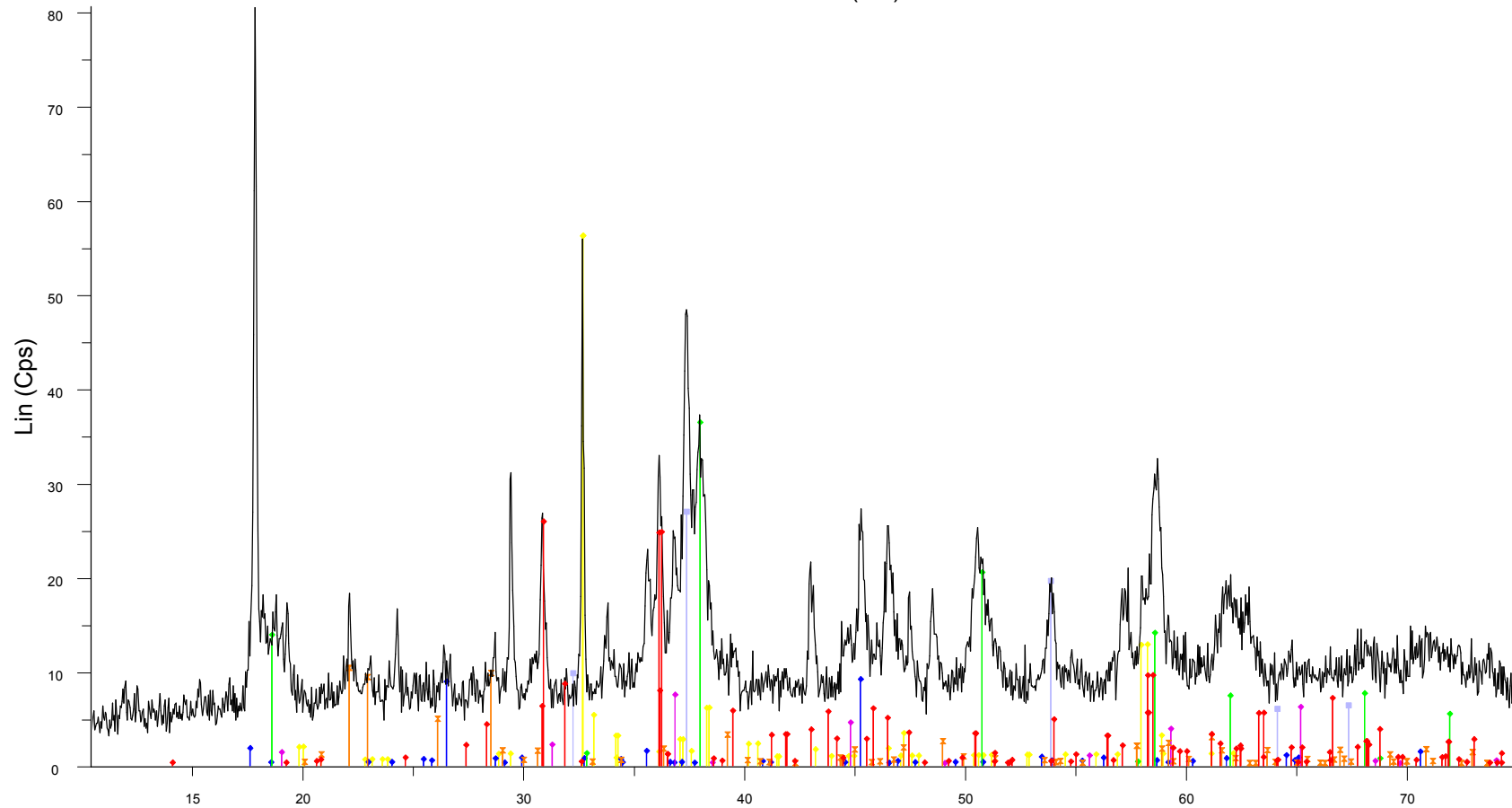
**Responsible for the analysis:**

Rainer Traksmaa

Research scientist  
Centre for Materials Research  
Tallinn University of Technology  
Ehitajate tee 5, 19086,  
Tallinn, Estonia

Appendix – X-Ray diffractograms of board samples.

TRILITE RMS board (red)



- TRILITE RMS board (red) - File: TRILITE RMS board (red).raw - Start: 10.400 ° - End: 75.000 ° - Step: 0.040 ° - Step time: 6. s - Anode: Cu - Creation: 13.06.2016 17:33:39 -
- 04-013-2114 (A) - Diopside, syn -  $\text{CaMgSi}_2\text{O}_6$  - Monoclinic - a 9.53888 - b 8.62672 - c 5.13341 - alpha 90.000 - beta 104.458 - gamma 90.000 - Base-centered - C2/c (15) - 409.047 - I/lc PDF 1.2 - 4
- 04-011-9020 (A) - Lime, syn -  $\text{CaO}$  - Cubic - a 4.80970 - b 4.80970 - c 4.80970 - alpha 90.000 - beta 90.000 - gamma 90.000 - Face-centered - Fm-3m (225) - 111.264 - I/lc PDF 4.5 - 4
- 00-048-0900 (I) - Potassium Magnesium Silicate -  $\text{K}_2\text{MgSiO}_4$  - Orthorhombic - a 10.96550 - b 5.40108 - c 15.60471 - alpha 90.000 - beta 90.000 - gamma 90.000 - Primitive - Pca21 (29) - 924.198 - I/lc PDF 1. - 8
- 00-058-2034 (I) - Muscovite-2M1 -  $\text{KAl}_2(\text{Si,Al})_4\text{O}_{10}(\text{OH})_2$  - Monoclinic - a 5.69063 - b 8.87999 - c 20.19360 - alpha 90.000 - beta 89.030 - gamma 90.000 - Base-centered - C2/c (15) - 1020.29 - I/lc PDF 1. - 4
- 04-013-9511 (\*) - brucite; Brucite, syn -  $\text{Mg}(\text{OH})_2$  - Hexagonal - a 3.14800 - b 3.14800 - c 4.77900 - alpha 90.000 - beta 90.000 - gamma 120.000 - Primitive - P-3m1 (164) - 41.0145 - I/lc PDF 2.3 - 1
- 04-008-8613 (A) - spinel, syn -  $\text{MgAl}_2\text{O}_4$  - Cubic - a 8.08667 - b 8.08667 - c 8.08667 - alpha 90.000 - beta 90.000 - gamma 90.000 - Face-centered - Fd-3m (227) - 528.821 - I/lc PDF 1.6 - 8
- 01-073-3469 (C) - Silicon Oxide -  $\text{SiO}_2$  - Tetragonal - a 4.43014 - b 4.43014 - c 16.10901 - alpha 90.000 - beta 90.000 - gamma 90.000 - Primitive - P4322 (95) - 316.158 - I/lc PDF 1.8 - 8

***This certificate of the analysis is to be reprinted as a whole. For the partial reprinting the written permission from the Centre for Materials Research should be inquired.***