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Determination of VOC, SVOC and VVOC emissions from building products - AgBB requirements

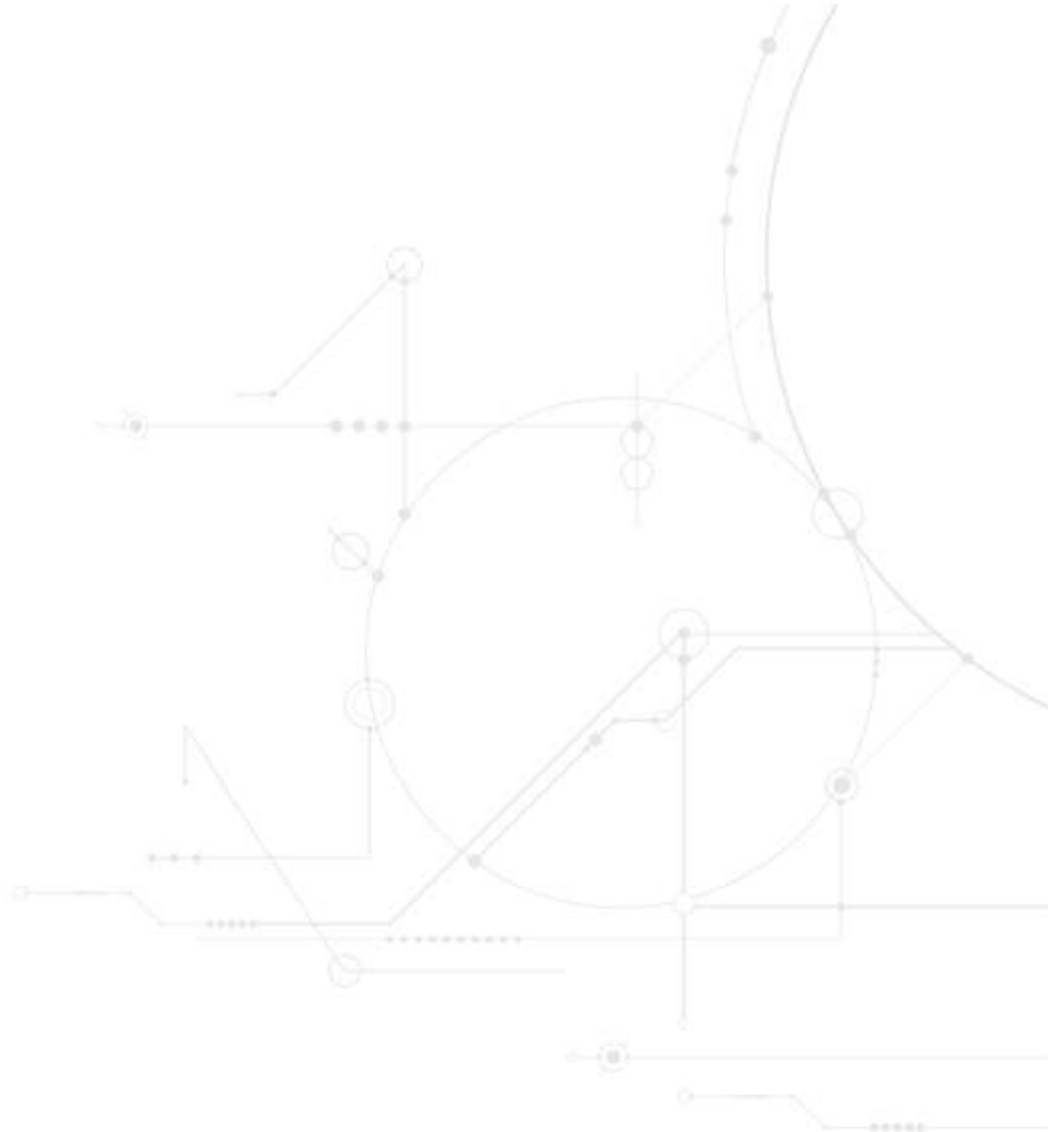
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Identification of the Material: DYNAPOK AL AGUA 2/C



Industrias Juno, S.A.



The results presented refer only to the item tested.

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0. DOCUMENTAL CONTROL

0.1 IDENTIFICATION OF DOCUMENT

Projet	---
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0.2 CONTROL OF VERSIONS

Version	Edition	Revision	Date	Description	Approved by
1	1	0	2019-11-15	Original version	GV

0.3 AUTHOR(S)

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0.5 LIST OF DISTRIBUTION

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1. OBJECTIVE

Determination of emissions of Volatile Organic Compounds (VOC), Semi Volatile Organic Compounds (SVOC) and Very Volatile Organic Compounds (VVOC) from a sample of a flooring material in order to obtain the material classification under the criteria established by AgBB – Evaluation procedure for VOC emissions from building products (2018).

2. CLIENT

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Reference of Proposal: PE30190744 by 11 September 2019

3. METHODOLOGIES USED

The study was conducted on a sample of flooring product, designated as "DYNAPOK AL AGUA 2/C". The sample was delivered at LQAI on 2019/09/23. The selection of the product sample was the sole responsibility of the client. The sample was applied in a glass according to the instructions provided by the manufacturer on 2019/10/07.

The characteristics of the product are as follows:

δ_r (μm)	ρ (g/cm^3)	$\emptyset$ (%)	S (m^2/L)	n_c	m (g/m^2)
68.8 (Class high)*	1.4	55	8	1	175

*Classification of dry film thickness according ISO16000-11¹

where, δ_r is the dry film thickness following recommendations of the manufacturer, ρ is the density of wet product, $\emptyset$ is the solid content of the product, expressed as a volume, S is the recommended spreading rate of the product, n_c is the number of coats and m is the amount of wet product to be applied per square meter.

The application conditions were:

m_a (g)	A (m^2)	C (kg/m^2)	δ_r (μm)
14.1	0.0810	0.174	68.2

where, m_a is the mass of the applied product, A is the glass area, C is the total amount of applied product per area, and δ_r is the real dry film thickness. Note that sample preparation is outside the scope of laboratory accreditation.

The test in the test chamber started on 2019/10/07 and was performed according to the internal proceeding IT.403 (based on ISO 16000-9²). This test is accredited in accordance with EN ISO / IEC 17025³ for the compounds:

Test	Method
Determination of Benzene – method of emission in test chamber	IT.403.05
Determination of Toluene - method of emission in test chamber	IT.403.05
Determination of Ethylbenzene - method of emission in test chamber	IT.403.05

Note: IT.nnn.nn indicates internal laboratory procedure.

It should be noted that the remaining compounds determined in this test and are out the scope of accreditation, are determined using the same quality standards that apply to them.

The VOCs and SVOCs samples were collected, in tubes with Tenax TA, when the test chamber was empty (2019/10/07, volume: 5.62 l) and in duplicate after 3 days (2019/10/10, average volume: 5.11 l), and 28 days (2019/11/04, average volume: 5.62 l) after starting the test.

Formaldehyde, acetaldehyde, acrolein and acetone were collected in cartridges impregnated with DNPH when the test chamber was empty (2019/10/07, volume: 73.3 l) and after 3 days (2019/10/10, volume: 80.4 l) and 28 days (2019/11/04, volume: 66.9 l) after starting the test.

The experimental conditions in the chamber during the study were:

Period	T (°C)	HR (%)	v (m/s)	n (h ⁻¹)	A/V (m ² /m ³)
28 days	22.0±0.4	50.5±2.6	0.10	1.0	0.83

where T is the temperature, HR the relative humidity, v the air velocity at the surface of the material, n the air exchange rate and A/V the ratio of sample area to chamber volume (loading factor). The volume of the chamber used is 0.098 m³.

For the analysis, thermal desorption on line with gas chromatography coupled to a mass spectrometer detector for VOC and SVOC identification and quantification (GC/MSD) was used. The GC used is from Agilent Technologies, model 6890N/7890A and the mass spectrometer detector is from Agilent also, model 5973/5975C. The thermal desorption system is from DANI, model STD 33.50/TD Master. The analysis was conducted on 2019/10/11 and 2019/11/04 according to the internal proceeding IT.401 (based on ISO 16000-6⁴). This test is accredited in accordance with EN ISO / IEC 17025³ for the compounds:

Test	Method	Uncertainty
Determination of Benzene by thermal desorption and Gas chromatography with mass selective detector	IT.401.05	± 6.2
Determination of Toluene by thermal desorption and Gas chromatography with mass selective detector	IT.401.05	± 4.2
Determination of Octane by thermal desorption and Gas chromatography with mass selective detector	IT.401.05	± 9.5
Determination of Ethylbenzene by thermal desorption and Gas chromatography with mass selective detector	IT.401.05	± 5.4
Determination of 2-Ethoxyethylacetate by thermal desorption and Gas chromatography with mass selective detector	IT.401.05	± 13
Determination of 1,2,4-trimethylbenzene by thermal desorption and Gas chromatography with mass selective detector	IT.401.05	± 7.4
Determination of 2-ethyl-1-hexanol by thermal desorption and Gas chromatography with mass selective detector	IT.401.05	± 13
Determination of limonene by thermal desorption and Gas chromatography with mass selective detector	IT.401.05	± 8.6
Determination of dodecane by thermal desorption and Gas chromatography with mass selective detector	IT.401.05	± 4.6
Determination of 2-phenoyethanol by thermal desorption and Gas chromatography with mass selective detector	IT.401.05	± 20
Determination of tridecane by thermal desorption and Gas chromatography with mass selective detector	IT.401.05	± 5.3
Determination of styrene by thermal desorption and Gas chromatography with mass selective detector	IT.401.05	± 6,2
Determination of tetrachloroethylene by thermal desorption and Gas chromatography with mass selective detector	IT.401.05	± 9.4

Nota: IT.nnn.nn indicates internal laboratory procedure.

All expanded uncertainty values presented were calculated using the expansion factor of 2.01, corresponding to a 95% confidence level.

It should be noted that the remaining compounds determined in this test which are not covered by the accreditation are determined using the same quality standards as applied to them. The emission factors of the identified compounds were determined using the specific response factor, when possible. Total volatile organic compounds (TVOC) concentration was calculated for all compounds with concentration higher than $5 \mu\text{g}/\text{m}^3$, eluted between hexane and hexadecane, using the specific response factor for the identified compounds, and the toluene response factor in the remaining cases. Total semivolatile organic compounds (TSVOC) concentration was calculated for all compounds with concentration higher than $5 \mu\text{g}/\text{m}^3$, eluted between hexadecane and docosane, using toluene response factor.

Formaldehyde, acetaldehyde, acrolein and acetone were determined according to the internal proceeding IT.402 (based on ISO 16000-3⁵). Specifically, the compounds were analysed by high performance liquid chromatography (HPLC) using a chromatograph Agilent Technologies brand, model 1220 Infinity LC. The emission factor of the compounds was calculated based on the specific response factor of the analytical method. The analysis took place on 2019/10/17 and 2019/11/08. The uncertainty of the analytical method for formaldehyde is $\pm 13\%$ and for acetaldehyde is $\pm 12\%$. This analysis is out the scope of accreditation.

4. RESULTS

Table 1 show the emission factor for TVOC and individual compounds quantified as well as the results of the application of the AgBB (2018)⁶ criteria, considering the specific ventilation rate (qe) of 1.25 m³ h⁻¹ m⁻².

Table 1. Emission factors for the compounds quantified in the emissions from the sample of the material 'DYNAPOK AL AGUA 2/C' for 3 days and 28 days of exposure for a specific ventilation rate of 1.25 m³ h⁻¹ m⁻². and application of AgBB criteria.

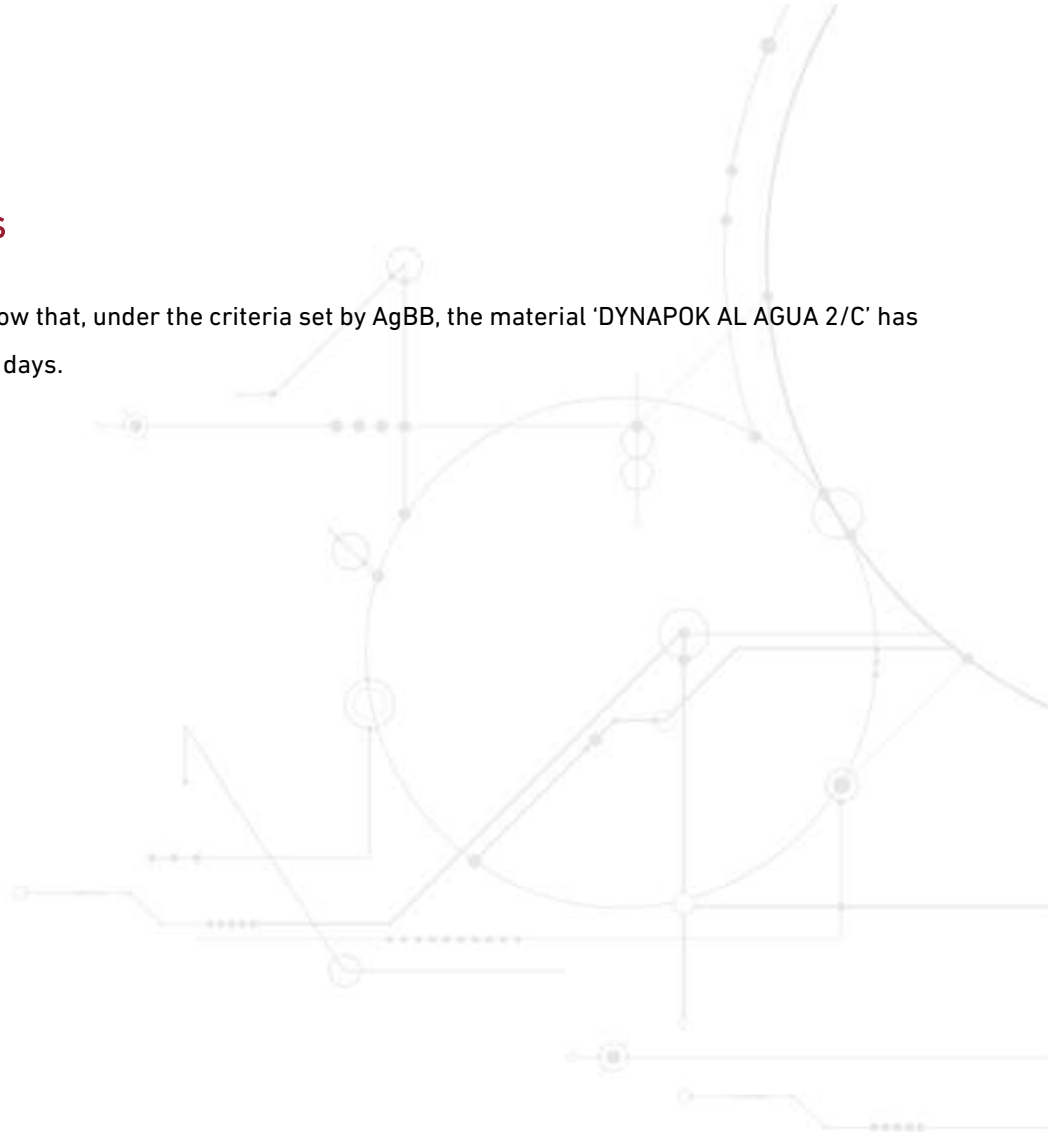
Compound	CAS	LCI (µg/m ³)	Emission Factor (µg/(m ² h))	
			3 days	28 days
2-methylphenol ⁺	95-48-7	---	6,01	n.d.
Oxirane, [(2-methylphenoxy)methyl]- ⁺	2210-79-9	---	367	n.d.
formaldehyde ⁺	50-00-0	100	2.30	n.d.
acetaldehyde ⁺	75-07-0	1200	n.d.	n.d.
acetone ⁺	67-64-1	1200	n.d.	n.d.
acrolein ⁺	107-02-8	14	n.d.	n.d.
TVOC ⁺	---	---	373	n.d.
TSVOC ⁺	---	---	n.d.	n.d.
Parameter to be assessed	Condition to be fulfilled		Results	
	3 days			
Carcinogenic VOCs (µg/m ³)	< 10		n.d.	
TVOC (µg/m ³)	< 10000		298	
	28 days			
TVOC (µg/m ³)	< 1000		n.d.	
TSVOC (µg/m ³)	<100		n.d.	
R = Σ (Ci/LCII)	< 1		0	
Σ Cn (µg/m ³)	< 100		n.d.	
EVALUATION			Positive	

LCI – Lowest concentration of interest; SVOC – Semi volatile organic compounds (> C16-C22); R - Index summarising the estimated health risk of a material emission (only listed substances whose concentrations in the test chamber air exceed 5 µg/m³ are evaluated based on LCI); Ci – concentration of an individual compound for which a LCI value is know; Ci = FE / qe; Σ (Cn) - Sum of the concentrations of the compounds, after 28 days of exposure, non-identified or for which a LCI value is not know; Cn = FE / qe; n.d. – not detected (equivalent to say below limit of detection),

⁺ Out of the scope of accreditation.

5. GENERAL CONCLUSIONS

The results presented in Table 1 show that, under the criteria set by AgBB, the material 'DYNAPOK AL AGUA 2/C' has a positive evaluation after 3 and 28 days.



6. REFERENCES

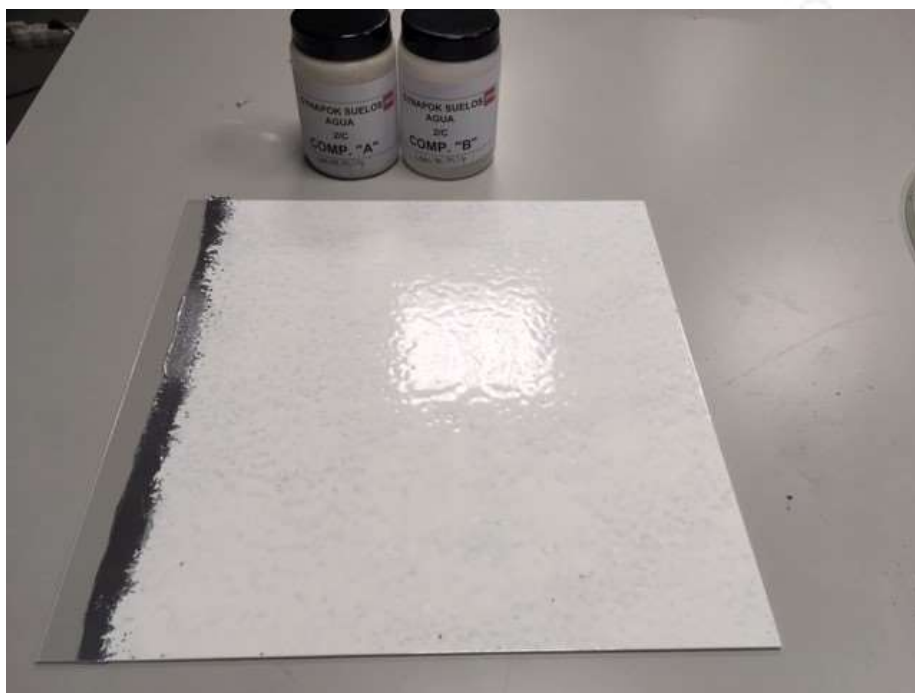
- 1- ISO 16000-11 (2006). Determination of the emission of volatile organic compounds from building products and furnishing — Sampling, storage of samples and preparation of test specimens (2006). Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method.
- 2- ISO 16000-9 (2006). Determination of the emission of volatile organic compounds from building products and furnishing - Emission test chamber method.
- 3- NP EN ISO/IEC 17025 – Requisitos gerais de competência para laboratórios de ensaio e calibração.
- 4- ISO 16000-6 (2011). Determination of volatile organic compounds in indoor and test chamber air by active sampling on Tenax TA sorbent, thermal desorption and gas chromatography using MS/FID.
- 5- ISO 16000-3 (2011). Determination of formaldehyde and other carbonyl compounds - Active sampling method.
- 6- AgBB - Evaluation procedure for VOC emissions from building products (2018).

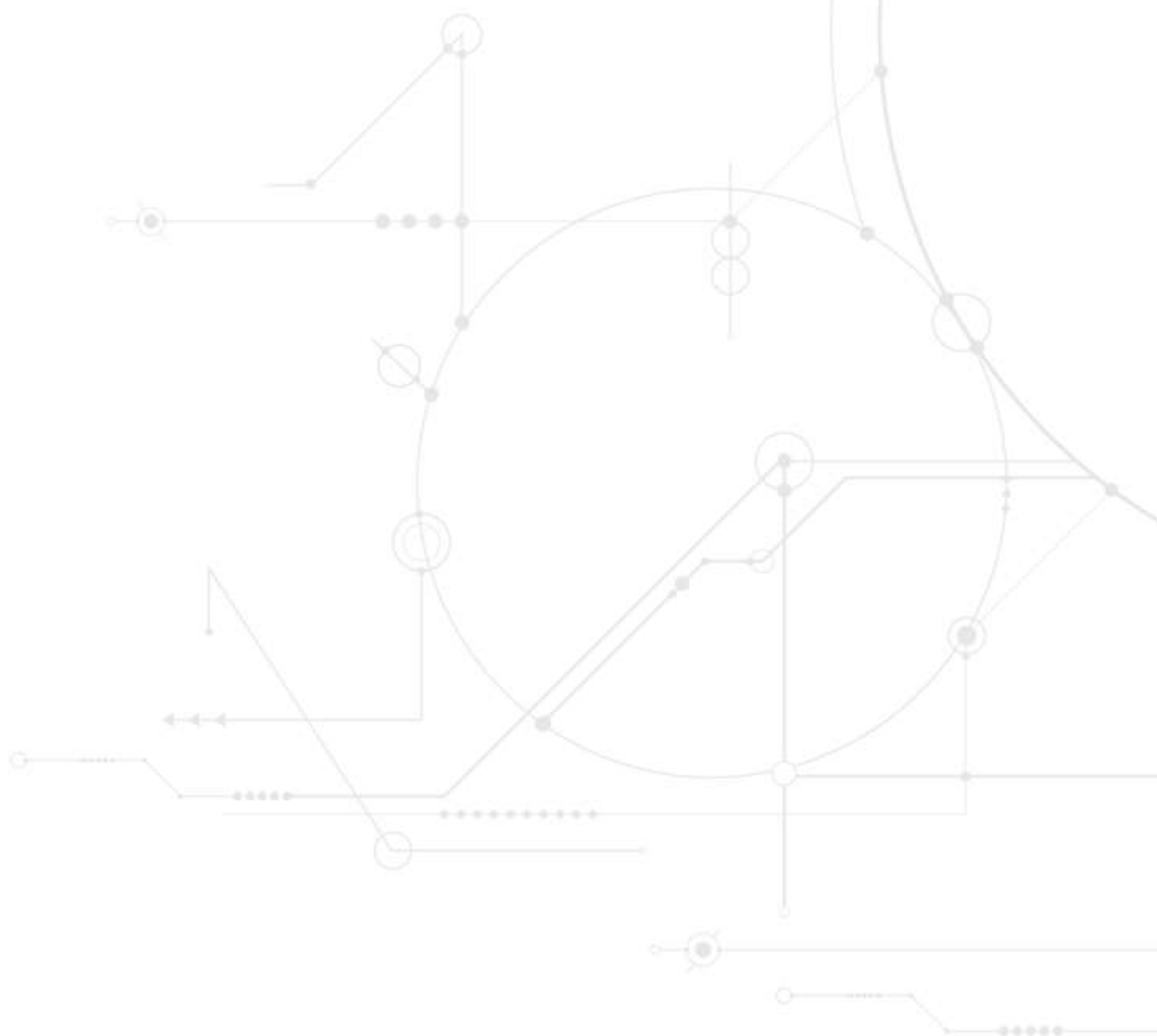
Porto, 15 November 2019



(Head of Laboratory)

Annex: Photo of the sample of the material under study





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