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HORIZONTAL FLAMMABILITY TEST ACC. TO UL 94 (50 W) - END-PRODUCTS WITH WALL THICKNESS ABOVE 25 μm

Zemědělské družstvo Haňovice - Plasty Mladeč

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1. Definition and test scope

The vertical flammability test according to UL 94 is intended for evaluating the degree of self-extinguishing properties of the material and its tendency to releasing flammable drippings during combustion. The test can be applied for solid of samples with a wall thickness greater than 250 μm . For lower material thicknesses, especially film materials with thickness in the range of 10 - 250 μm , it is necessary to proceed from the vertical flammability test according to UL 94 with the final classification VTM-0 to VTM-2. The material is tested in the form of a vertically placed bar specimen. The standardized 50 W flame is applied on the lower free end of bar. The material is ignited in a vertical position with a low-energy and low-heat blue flame of 50 W (gas source: methane). The flame height is adjusted to 20 mm, and the sample must be placed so that its lower edge is 10 mm from the very top of the burner. The flame is usually applied at an angle of 45° to the lower edge of the sample. In the first cycle, the flame is applied for 10 s, then the pilot flame is removed. If the material extinguishes within 10 s after the pilot flame removal, the flame is applied for a second time for another 10 s. After the second ignition, the flame is removed and the typical nature of burning behavior is observed. According to the result, the material is divided into the one of the possible classifications. In one set, 5 samples are always evaluated.

classification 94V-0

- the material must not burn completely
- the material must self-extinguish within 10 seconds after each application of the flame
- the sum of burning for all 10 ignitions must not exceed 50 s
- the drippings during burning must not ignite the cotton placed under the sample
- the burning time of the material must not exceed 30 s even during one ignition

classification 94V-1

- the material must not burn completely
- the material must self-extinguish within 30 seconds after each application of the flame
- the sum of burning for all 10 ignitions must not exceed 250 s
- the drippings during burning must not ignite the cotton placed under the sample
- the burning time of the material must not exceed 60 s even during one ignition

classification 94V-2

- the material must not burn completely
- the material must self-extinguish within 30 seconds after each application of the flame
- the sum of burning for all 10 ignitions must not exceed 250 s
- the drippings during burning must not ignite the cotton placed under the sample
- the burning time of the material must not exceed 60 s even during one ignition

If the material does not meet any of the mentioned criteria, it does not meet the conditions to fulfill the flammability classification according to UL 94 - vertical test.

2. Tested materials

The customer supplied a total of 10 pieces of 3D printed specimens (100% infill) with dimensions 124 × 13 × 3.5 mm. The specimens were prepared using PC/ABS compound with designation BAYBLEND FR3030.



Fig. 1: Images of supplied bar specimens

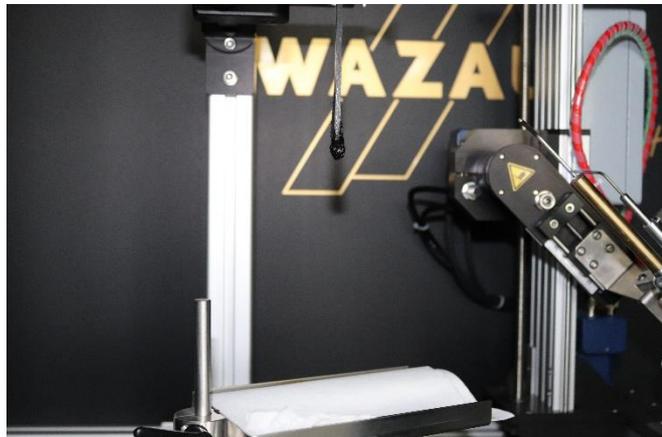
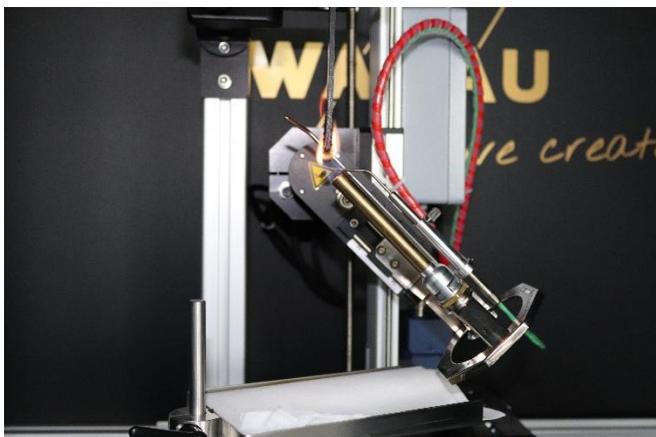


		VERTICAL FLAMMABILITY TEST (50 W)				
Standard:	UL 94					
Classification:	94V-0, 94-V1 and 94V-2 rating					
Tested material:	Bayblend FR3030					
Material specification:	PC/ABS compound, black color					
Material form:	3D printed bar specimen (100 % infill)					
Specimen dimensions:	124 × 13 mm					
Specimen thickness:	13.5 ± 0.1 mm					
Reference mark:	125 mm from lower free-end edge					
Pilot flame height:	20 mm (50 W)					
Time of flame application:	10 s (2×)					
Conditioning:	24 hours, 23 °C, 50 % RH					
Test processed by:	Pavel Huljak			Date:	15 th of April 2023	
Test evaluated by:	Pavel Huljak			Date:	15 th of April 2023	
<i>N^o of tested specimen</i>						
	<i>spc. 1</i>	<i>spc. 2</i>	<i>spc. 3</i>	<i>spc. 4</i>	<i>spc. 5</i>	<i>Average value</i>
t₁ [s]	0	0	0	0	0	0
t₂ [s]	3	4	2	5	6	4
GCO [s]	0	0	0	0	0	0
TBO	no	no	no	no	no	/
FD	no	no	no	no	no	/
D	no	no	no	no	no	/
CI	no	no	no	no	no	/
TFC [s]	20					
UL 94 classification:	94V-0					
Comments:	<ul style="list-style-type: none"> - specimens burnt with an intense flame during flame application, after pilot flame removal specimens tended to self-extinguish themselves - specimens did not drip or glow during the test - burning was accompanied by the formation of medium smoke density 					
t₁:	<i>Burning time after 1st flame application</i>					
t₂:	<i>Burning time after 2nd flame application</i>					
GCO	<i>Glowing time after 2nd flame application</i>					
TBO	<i>Total burning of the specimen to the upper holder</i>					
FD	<i>Flammable drippings presence</i>					
D	<i>Non-flammable drippings presence</i>					
CI	<i>Cotton ignition</i>					
TFC	<i>sum of the burning time for 10 ignition of total</i>					

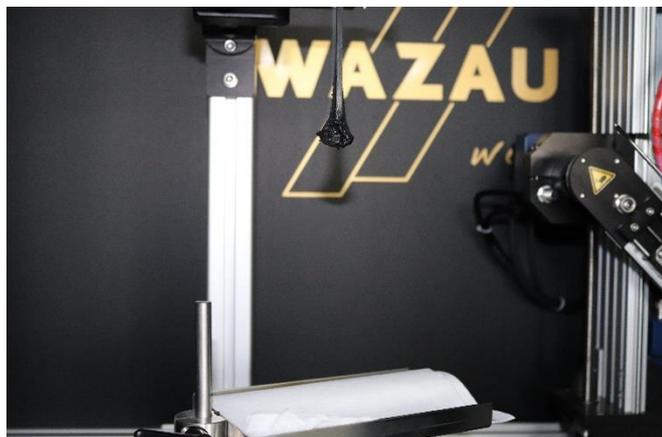
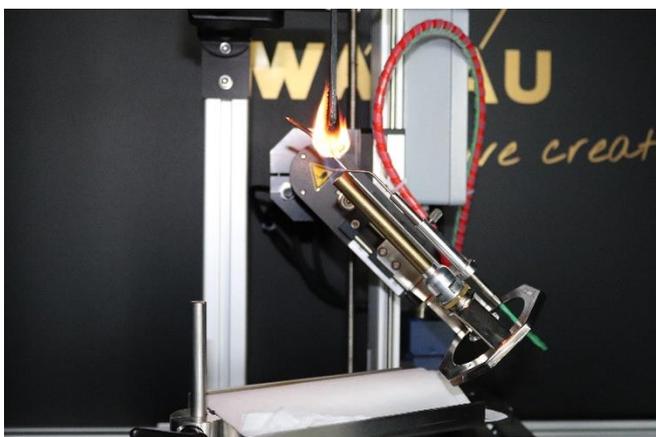
During flame application

After flame removal

1st flame application



2nd flame application



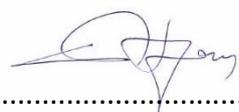
3. Conclusion

The tested material Bayblend FR3030 meets the flammability classification V-0 according to UL 94 flammability standard. The obtained results refer exclusively to the tested specimens as supplied, so in the 3.5 mm thickness version and 100 % infill.

The author of the report confirms the correctness of the measured and stated data, relating only to the current tested samples. The comments and conclusions drawn are entirely based on the obtained experimental data and do not represent any guidance or authorization for own self-interpretation of the listed results. Therefore, without testing laboratory written consent, it is not possible to reproduce the protocol other than in its entirety.

Brno

Date: 15th of April 2023



Pavel Huljak