



# Refill N



# CHARACTERISTICS OF THE MATERIAL

## STEREO MICROSCOPIC OBSERVATION

The figure below shows the product and the stereo microscopic observation of the cutting surface of the **Refill N**.

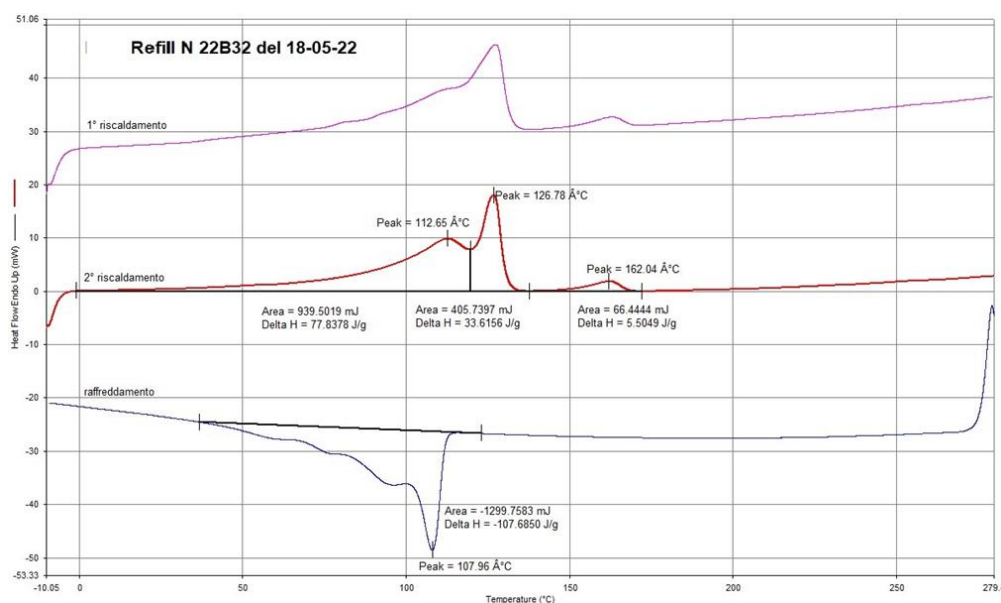


## DSC ANALYSIS

The **Refill N** granules were analyzed by DSC with the following thermal program:

- 1° heating from -10°C a 280°C, 20 °C/min in N<sub>2</sub>
- Cooling from 280°C a -10°C, -20 °C/min in N<sub>2</sub>
- 2° heating from -10°C a 280°C, 20 °C/min in N<sub>2</sub>

The figure below shows the DSC thermogram relating to the **Refill N** samples



*Refill N thermogram*

The DSC analysis shows that the **Refill N** granule is composed by of three main polymers, such as LDPE, HDPE and PP as demonstrated by the three different melting points in the thermogram. The table shows the indicative percentages calculated based on the fusion enthalpy.

| Refill N   |                    |
|------------|--------------------|
|            | % in the blend (*) |
| LLDPE/LDPE | 65                 |
| HDPE       | 30                 |
| PP         | 5                  |

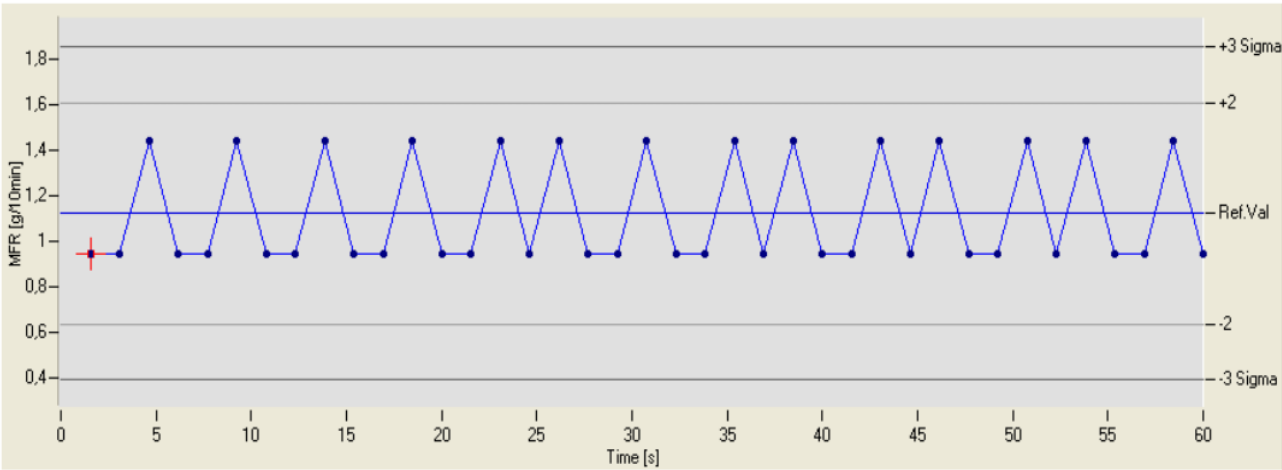
Composition of Refill N (\*) The reported components percentages are indicative

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MELT FLOW RATE (MFR)

A MFR analysis was carried out on **Refill N** granules according to the ASTM D1238A standard with a weight of 2.16 kg. The analysis was performed at **190 °C**, preheating the sample for 180 seconds and recovering the material for 60 seconds. The instrument also measures the Melt Volume Rate (MVR) during the test.  
The average results of MFR and MVR are reported in the table below.

| Sample   | MFR (Average value) | MVR (Average value)    |
|----------|---------------------|------------------------|
| Refill N | 0.9 g/10 min        | 1,12 ± 0,24 cm³/10 min |



Trend of the MVR as a function of time for the sample of Refill N at 190 °C

### ASH ANALYSIS

The ashes were analyzed in accordance with the ISO 3451 and they were analyzed also by FT-IR spectroscopy. The analysis shows the presence of **inorganic salts, silicates and calcium oxide**. The table shows the results of the quantitative analysis carried out on the **Refill N**.

| Sample   | % ashes (Average data) |
|----------|------------------------|
| Refill N | 2,3                    |

Average result for ashes determination

### MOISTURE ASSESSMENT

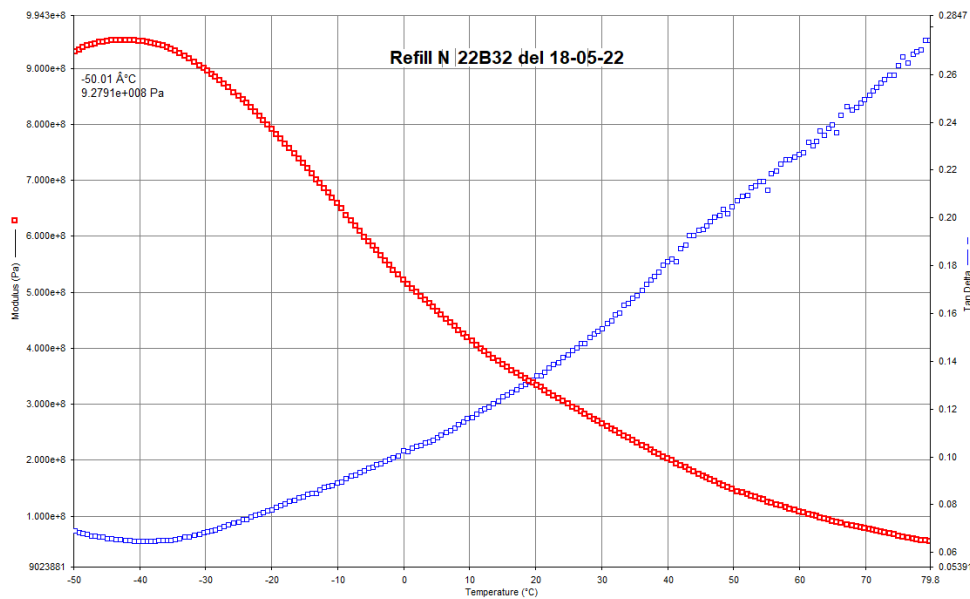
The moisture assessment was performed following the UNI 10667-16 standard. A **Refill N** sample was dried into an oven at 100°C for 8 h. The residual moisture in the granules was less/equal to 0.2%

| Sample   | % Moisture (Average data) |
|----------|---------------------------|
| Refill N | ≤ 0.2                     |

Average values of moisture in the Refill N granules

### DMA ANALYSIS

The sample of **Refill N** was analyzed by DMA in single cantilever mode with an oscillation frequency equal to 1Hz, according in a range of temperature between a thermal program -50 °C to 80 °C at 5 °C/ min.



DMA graph of Refill N, the red curve indicates the storage modulus  $E'$  blue curve the TanDelta

The **Refill N** has an initial storage modulus  $E'$  equal to 9,28 E+08 Pa. The glass transition temperature is not visible in the analyzed temperature range.

# TECHNICAL DATA SHEET

## Refill N - Polyolefin blend

| Property                                                                                                                                                                                                                                                                                                                                                                                                                        | Test method    | Test conditions | Unit of measurement | Typical value |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|-----------------|---------------------|---------------|
| <b>PHYSICAL</b>                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                 |                     |               |
| Density                                                                                                                                                                                                                                                                                                                                                                                                                         | ASTM D 792-91  | 23°C            | g/cm <sup>3</sup>   | 0,96          |
| Melt Flow Rate (MFR)                                                                                                                                                                                                                                                                                                                                                                                                            | ASTM D 1238A   | 190/2,16        | g/10 min            | 0,9           |
| Ash percentage                                                                                                                                                                                                                                                                                                                                                                                                                  | ISO 3451       |                 | %                   | 2,3           |
| Moisture percentage                                                                                                                                                                                                                                                                                                                                                                                                             | UNI 10667-16   |                 | %                   | ≤ 0,2         |
| <b>MECHANICAL</b>                                                                                                                                                                                                                                                                                                                                                                                                               |                |                 |                     |               |
| Izod impact strength test                                                                                                                                                                                                                                                                                                                                                                                                       | ISO 180A       | 23°C            | KJ/m <sup>2</sup>   | 40 ± 6,0      |
| Izod impact strength test                                                                                                                                                                                                                                                                                                                                                                                                       | ISO 180A       | -20°C           | KJ/m <sup>2</sup>   | 17 ± 5,0      |
| Bending modulus of elasticity                                                                                                                                                                                                                                                                                                                                                                                                   | ISO 178        |                 | N/mm <sup>2</sup>   | 331           |
| Tensile strength modulus of elasticity                                                                                                                                                                                                                                                                                                                                                                                          | ISO 527        |                 | N/mm <sup>2</sup>   | 378           |
| <b>THERMAL</b>                                                                                                                                                                                                                                                                                                                                                                                                                  |                |                 |                     |               |
| HDT Heat Deflection Temperature                                                                                                                                                                                                                                                                                                                                                                                                 | ASTM D 648-96  |                 | °C                  | nd            |
| VICAT Heat penetration index                                                                                                                                                                                                                                                                                                                                                                                                    | ASTM D 1525-96 |                 | °C                  | nd            |
| Melting point (for each mixture peak)                                                                                                                                                                                                                                                                                                                                                                                           | ASTM D 3418-97 |                 | °C                  | 113, 127, 163 |
| <b>MOLDING CONDITIONS</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                |                 |                     |               |
| Barrel temperature                                                                                                                                                                                                                                                                                                                                                                                                              |                |                 | °C                  | 190 - 220     |
| Mould temperature                                                                                                                                                                                                                                                                                                                                                                                                               |                |                 | °C                  | 30-60         |
| Drying temperature                                                                                                                                                                                                                                                                                                                                                                                                              |                |                 | °C                  | 60-80         |
| Drying time                                                                                                                                                                                                                                                                                                                                                                                                                     |                |                 | h                   | 4             |
| <p>The product complies with the UNI 10667 standard</p> <p>The data shown are the average values of a significant sample of the product and are provided to supply information to the user; they do not constitute any warranty and do not imply in general terms any guarantee or commitment by the Company. The mean value obtained in the tensile tests have a confidence interval established at 95% of the mean value.</p> |                |                 |                     |               |

## COMPLIANCE OF THE MATERIAL WITH THE REACH REGULATION

The table shows the results of the analysis performed on the sample to assess its compliance with the Reach Regulation.

| Parameter                      | Unit of measurement | Method                | Result |
|--------------------------------|---------------------|-----------------------|--------|
| PCB (polychlorinated biphenyl) | mg/kg               | EPA 3550C<br>EPA8270E | <0,31  |

| CHLOROPARAFFINS |       | EPA 3550C<br>EPA8270E |        |
|-----------------|-------|-----------------------|--------|
| C10-C13         | mg/kg |                       | < 10,0 |
| C14-C17         | mg/kg |                       | < 10,0 |
| C18-C20         | mg/kg |                       | < 10,0 |

| PHTHALATES                         |       | EN ISO<br>16181-<br>1:2021 |     |
|------------------------------------|-------|----------------------------|-----|
| DI-N-BUTYL PHTHALATE (DBP)         | mg/kg |                            | <50 |
| DI - ISOBUTYL PHTHALATE (DIBP)     | mg/kg |                            | <50 |
| BENZYL BUTYL PHTHALATE (BBP)       | mg/kg |                            | <50 |
| BIS(2-ETHYLHEXYL) PHTHALATE (DEHP) | mg/kg |                            | 57  |
| DI-ISO NONIL PHTHALATE (DINP)      | mg/kg |                            | <50 |
| DI-ISO DECIL PHTHALATE (DINP)      | mg/kg |                            | <50 |
| DI-N -OCTIL PHTHALATE (DNOP)       | mg/kg |                            | <50 |

| POLYCYCLIC AROMATIC<br>HYDROCARBONS (IPA) |       | EPA 3550C<br>EPA8270E |      |
|-------------------------------------------|-------|-----------------------|------|
| NAPHTALENE                                | µg/kg |                       | <100 |
| ACENAPHTHYLENE                            | µg/kg |                       | <100 |
| ACENAPHTHENE                              | µg/kg |                       | <100 |
| FLUORENE                                  | µg/kg |                       | <100 |
| PHENANTHRENE                              | µg/kg |                       | <100 |
| ANTHRACENE                                | µg/kg |                       | <100 |
| FLUORANTHENE                              | µg/kg |                       | <100 |
| PYRENE                                    | µg/kg |                       | <100 |
| BENZ(a)ANTHRACENE                         | µg/kg |                       | <100 |
| CHRYSENE                                  | µg/kg |                       | <100 |
| BENZO(b)FLUORANTHENE                      | µg/kg |                       | <100 |
| BENZO(k)FLUORANTHENE                      | µg/kg |                       | <100 |
| BENZO(j)FLUORANTHENE                      | µg/kg |                       | <100 |
| BENZO(e)PYRENE                            | µg/kg |                       | <100 |
| BENZO(a)PYRENE                            | µg/kg |                       | <100 |
| PERYLENE                                  | µg/kg |                       | <100 |
| INDENO(1,2,3-cd)PYRENE                    | µg/kg |                       | <100 |
| DIBENZ(a,h)ANTHRACENE                     | µg/kg |                       | <100 |
| BENZO(g,h,i)PERYLENE                      | µg/kg |                       | <100 |
| DIBENZO(a,l)PYRENE                        | µg/kg |                       | <100 |
| DIBENZO(a,e)PYRENE                        | µg/kg |                       | <100 |
| DIBENZO(a,i)PYRENE                        | µg/kg |                       | <100 |
| DIBENZO(a,h)PYRENE                        | µg/kg |                       | <100 |

|                             |       |                           |      |
|-----------------------------|-------|---------------------------|------|
| HEXAVALENT CHROMIUM (CR VI) | mg/kg | ION<br>CHROMATO<br>GRAPHY | 38,1 |
|-----------------------------|-------|---------------------------|------|

|              |       |                                 |       |
|--------------|-------|---------------------------------|-------|
| HEAVY METALS |       |                                 |       |
| ANTIMONY     | mg/kg | UNI EN 13657<br>UNI EN ISO11885 | <21,1 |
| ARSENIC      | mg/kg | UNI EN 13657<br>UNI EN ISO11885 | <19,5 |
| CADMIUM      | mg/kg | UNI EN 13657<br>UNI EN ISO11885 | <1,3  |
| CHROMIUM     | mg/kg | UNI EN 13657<br>UNI EN ISO11885 | 4,0   |
| MERCURY      | mg/kg | UNI EN 13657<br>EPA 6010C       | <1,7  |
| NICKEL       | mg/kg | UNI EN 13657<br>UNI EN ISO11885 | <3,5  |
| LEAD         | mg/kg | UNI EN 13657<br>UNI EN ISO11885 | <15,8 |
| COPPER       | mg/kg | UNI EN 13657<br>UNI EN ISO11885 | 19,5  |
| SELENIUM     | mg/kg | UNI EN 13657<br>UNI EN ISO11885 | <34,0 |
| TIN          | mg/kg | UNI EN 13657<br>UNI EN ISO11885 | <10,5 |
| TELLURIUM    | mg/kg | UNI EN 13657<br>UNI EN ISO11885 | <28,2 |
| ZINC         | mg/kg | UNI EN 13657<br>UNI EN ISO11885 | 91,6  |

## APPLICATION EXAMPLES AND CURRENT PROJECTS





## **REJET SPA**

Società soggetta a Direzione e Coordinamento da parte di Alia servizi ambientali Spa

Viale America, 104 • Loc. Gello • 56025 • Pontedera (PI)

Tel. 0587 271211 • Fax 0587 271269

info@revet.

**www.revet.com**



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