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| --- |
| **Table 1. Mass in grams used in the formulations. Source: Authors** |
| **Samples** | **%EPSv** | **%EPSr** | **Mass EPSr (g)** | **Mass EPSv (g)** |
| **EPS0** | 100 | 0 | 0 | 28000 |
| **EPS10** | 90 | 10 | 2800 | 25200 |
| **EPS15** | 85 | 15 | 4200 | 23800 |
| **EPS20** | 80 | 20 | 5600 | 22400 |

Multipurpose boxes EPS

(Post-consumer)

Expandable polystyrene beads

Wash with industrial detergent

Weight measurement of the beads

Dry for x 24 hours

Shatter in mill

Pre-expansion steam

Silo conditioning

Homogenization

pneumatic transport

pneumatic transport

pneumatic transport

Measure weight milled EPSr

weight

Injection Molding

**Figure 1. Block diagram of the operations performed with the material. Source: Authors**

**Figure 2.** **Infrared spectrum for powder samples of polystyrene: (a)EPS0, (b) EPS10, (c) EPS15, (d) EPS20. Source: Authors**

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| **Table 2. Mechanical properties EPSv and mixtures between EPSv and EPSr . Source: Authors** |
|  **Samples****Properties** | **EPS0** | **EPS10** | **EPS15** | **EPS20** |
| **Compressive resistance (MPa)** | 0.11±0.00 | 0.11±0.00 | 0.11 ±0.00 | 0.11±0.00 |
| **Modulus of elasticity (MPa)** | 2.86±0.10 | 3.38 ±0.96 | 4.24 ±0.64 | 3.62±0.92 |
| **Maximum breaking load (N)** | 68.4 ±5.64 | 46.5 ±4.32 | 53± 5.17 | 52.1 ±3.28 |
| **Maximum displacement (mm)** | 23.1 ±3.35 | 23.1± 0.41 | 24± 7.41 | 22 ±3.31 |
| **Maximum stress (N/mm2)** | 0.5 ±0.05 | 0.3 ± 0.05 | 0.4± 0.05 | 0.4± 0.05 |
| **Maximum deformation (%)** | 5.5 ± 0.81 | 5.7 ± 0.82 | 5.8± 1.78 | 5.3± 0.79 |
| **Energy absorbed in the impact (J)** | 0.06± 0.00 | 0.06± 0.01 | 0.05±0.00 | 0.06± 0.00 |
| **Impact resistance (J/m)** | 5.43±0.21 | 6.03± 0.95 | 5.43± 0.21 | 6.18± 0.39 |
| **Table 3. Thermal properties EPSv and mixtures between EPSv and EPSr. Source: Authors** |
|  **Samples****Properties** | **EPS0** | **EPS10** | **EPS15** | **EPS20** |
| **Glass transition temperature (°C)** | 101.4 | 96.5 | 97.1 | 104.5 |
| **Specific heat *Cp* (KJ/Kg.K)** | 0.5 | 0.5 | 0.6 | 0.9 |
| **Onset temperatue of material degradation (°C)** | 326.7 | 300.2 | 318.6 | 313.6 |
| **Thermal conductivity *k* (W/mK)** | 0.059 | 0.070 | 0.062 | 0.056 |
| **Density ρ (Kg/m3)** | 23 | 22 | 23 | 22 |
| **Thermal diffusivity α (m2/s)** | 4,9x10-9 | 6,4x10-9 | 4,3x10-9 | 2,8x10-9 |

**Temperature (°C)**

**% of EPS mass \***

**Figure 3. Thermal Gravimetric Analysis (a) EPS0; (b) EPS10; (c) EPS15; (d) EPS20. Source: Authors**

**\***The mass percentage data concerning EPS10, EPS15 and EPS20 were intentionally displaced 20, 40, and 60%, respectively, in order to improve the display of the results.



**Figure 4. Linear distribution of temperatures in a plate thickness of 0,50m, unsteady state, with inhomogeneous boundary conditions (T(0,0)=0°C and T(0,0.5)=80°C); in a time interval 500, i.e. 2500 minutes (a) EPS0 with a α = 4,9x10-9 m2/s. (b) EPS10 with a α=6,2x10-9m2/s. (c) EPS15 with a α = 4,3x10-9 m2/s. (d) EPS20 with a α =2,8x10-9 m2/s. Source: Authors**

\*\*The temperature data concerning EPS10, EPS15, and EPS20 were intentionally displaced 10, 20, and 30° C, respectively, in order to improve the display of the results.