0.1 Density measurements

The density measurements have been carried out using instrument Gibertini E42. Three samples have been tested: PET, PET-T2 and PET-T3. The normative for this type of test is the ASTM D792 (Archimedean test), where each specimen has to been weighted in two different conditions, in air and liquid. In particular, for the measurement in the liquid, the sample have been placed inside a container filled with water, using an appropriate plate and mounting. Density of samples has been calculated using Equation 1.

$$\rho = \frac{m_a}{m_a - m_{acq}} \cdot \rho_w \tag{1}$$

where m_a and m_{acq} indicate respectively the mass in air and in water of the specimens and ρ_w indicates the water density, measured according to the normative.

0.2 Density measurements (results)

The water temperature has been measured obtaining a value of 22.6°C, so the water density used is 997.6351 kg/m^3. For each sample, three specimens have been tested. Results for each sample are reported in Table 1.

Tabella 1: Density measurements of PET bottles with different thermal treatment.

Sample	ρ **(kg/m^3)**
PET	1313±
PET-T2	1336±
PET-T3	1327±

This values can be compared with the ones obtained by literature [**?**], reported in Table 2:

Tabella 2: Density of PET from literature [**?**].

Cristallinity	ρ **(kg/m^3)**
Amorphus, non-oriented	1335
Calculated, crystal	1515

It can be observed that the amorphus PET density is different from the one calculated by Archimedean test. This can be explained by the presence of a certain amount of diethylene glycol (DEG), which increases the volume of samples by reducing the density. Starting from a different polymer with respect to the literature one, new values of density for totally crystalline and totally amorphus PET have been calculated. A comparison with data from the DSC has been done. Having the densities of the samples PET and PET-T2 from Table 1 and the crystallinity from Table **??**, using the straight line Equation 2

$$\rho = \rho_0 + m \cdot \alpha \tag{2}$$

it was possible to calculate the densities of 0% and 100% crystalline samples.

Tabella 3: Density and crystallinity of PET sample, considering the effect of DEG.

Sample	α (%)	ρ (kg/m^3)
Amorphus, non-oriented	0	1304
PET	8	1313
PET-T2	28	1336
Calculated, crystal	100	1419