Comparison of different thermoplastic polymers

Each thermoplastic polymer has their own physical, mechanical and chemical properties and it is important to know them in order to use them wisely…

Depending on the final application, some polymers have better properties and it is important to know which one will be the most suitable. In this article, we will take care to present some polymers with interesting properties in very particular cases.

1) Thermal resistant thermoplastic polymers :

Thermoplastic polymers are not known for their use at high temperatures. Indeed, in many applications, materials such as glass or metal are preferred. However, some polymers can be used easily at temperatures above 150°C or even 200°C. In this case, they are often lighter, cheaper and easier to shape than the materials mentioned above. This is the case with polymers such as PEI (operating temperature: T_{ut}°C= 180°C), PEEK (T_{ut}°C= 250°C) or PPSU (T_{ut}°C= 180°C).

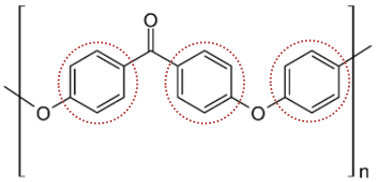


Figure 1 : PEEK structure

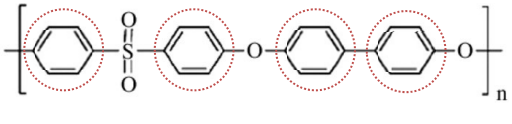


Figure 2 : PPSU structure

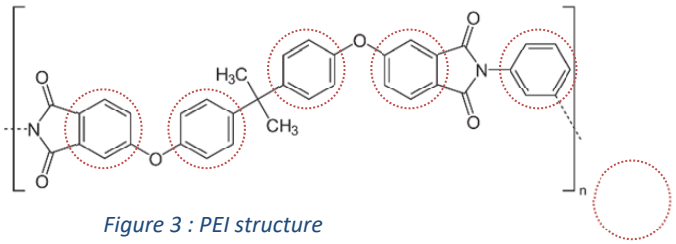


Figure 3 : PEI structure

: Aromatic rings

Chemically, this resistance is mostly explained by the structure of these polymers. The presence of an aromatic ring within the structure gives them thermostability. This can be explained by electron delocalization, that is to say a mesomeric effect throughout the polymer chain. The polymer is therefore protected against oxidation, which is responsible for the degradation of the polymer.

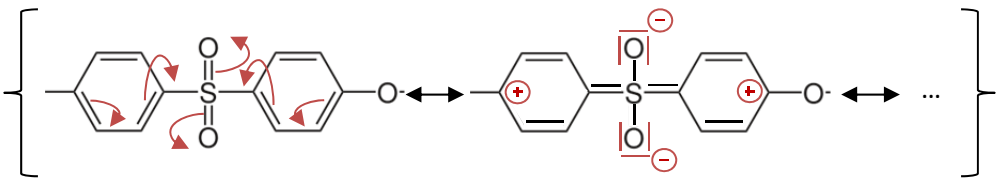
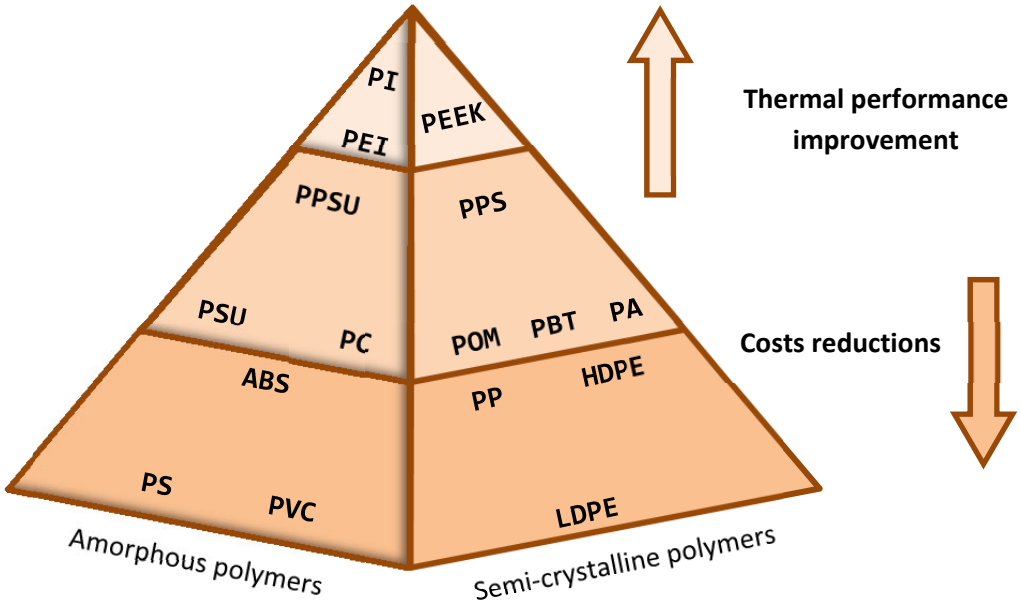


Figure 4 : Explanation of a mesomeric effect in a biphenyl-sulfonyl group

The oxidation of a polymer is characterized by electron loss. However, the possible delocalization within the mentioned polymer structures stabilizes

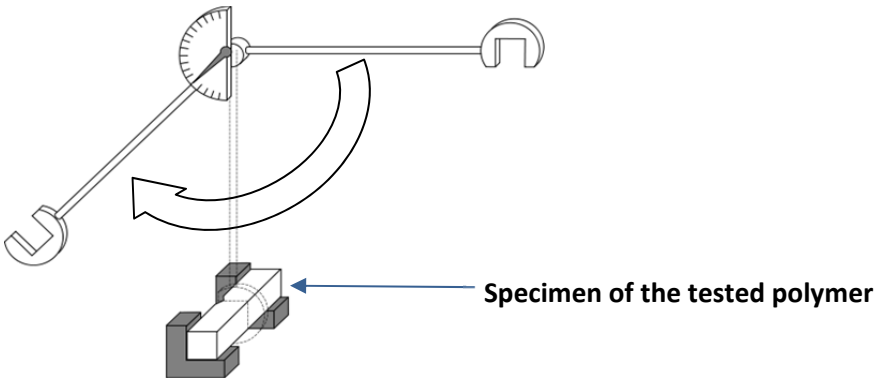
the position of the electrons. It is therefore more difficult to remove them. This requires more energy and therefore more heat... This explains the stability of these polymers at high temperatures!

The following pyramid is a good summary of the right polymers to use depending on the thermal conditions:



2) Impact energy of thermoplastic polymers:

The impact energy of polymers is evaluated in the laboratory using the Charpy impact test. This test is designed to measure the energy required to break a specimen in one go (previously notched or notched). It is thus possible to compare the different polymers and determine the most appropriate for the end use.



Feronyl's experience in polymer forming allows us to help you determine the best material. For example, for transmission systems such as gears, the use of polyamide or POM will be highly recommended. For defence and aerospace applications, materials such as PEEK or PEI are the one to be used.

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