Whitepaper

The use of Super-Technopolymer as a substitute for metal/stainless steel in standard machine components

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Background to the use of technopolymer

Despite the spread of polymers for technical products dating back to a relatively recent era (e.g. polyamide-based polymers in the USA after the Second World War and polypropylene-based ones after Giulio Natta's research in 1954, at Politecnico di Milano, Milan - Italy n.d.t. a Scientific-technological University) the so called engineering plastics have now taken a firm place in our everyday life, replacing materials previously deemed "noble" such as metal alloys, glass or wood.

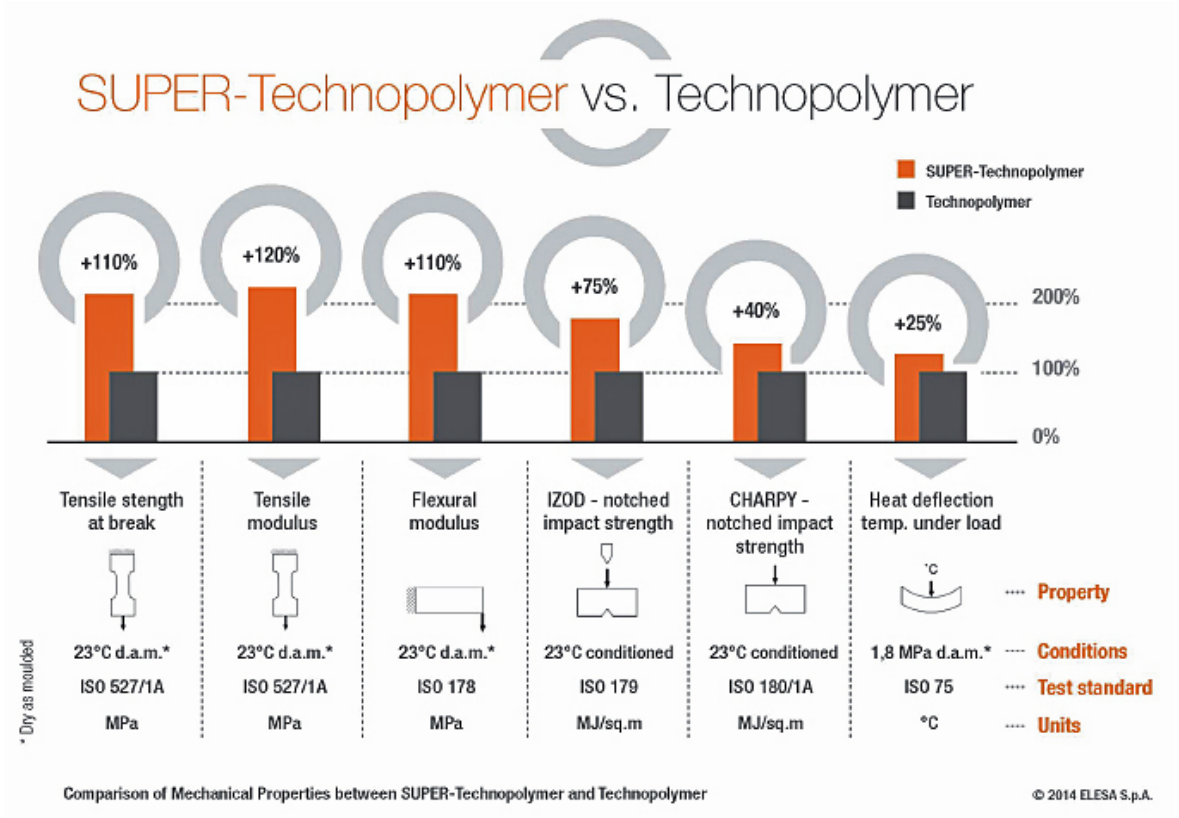
The most technologically advanced industries, for example automotive, aerospace and electronics, long ago understood the many benefits arising from the use of these engineering plastics and have promoted the creation of research centres to develop new high-performance polymers. Such that today 50% of the volume of the materials present in a modern motor car are made of high grade plastic materials, with uses until very recently quite unthinkable, such as air intake manifolds, engine components, lights, doors and hatches.

With more than 70-years of experience, Elesa has been a pioneer in the design and production of standard components for industrial machines and equipment, focusing from the beginning on the use of polymers while paying great attention to the development of specialist new technopolymers thanks to an active collaboration with Politecnico di Torino, (Turin), a particular centre of research for the automotive industry, also with Proplast of Alessandria, technology centre for the engineering of polymeric materials.

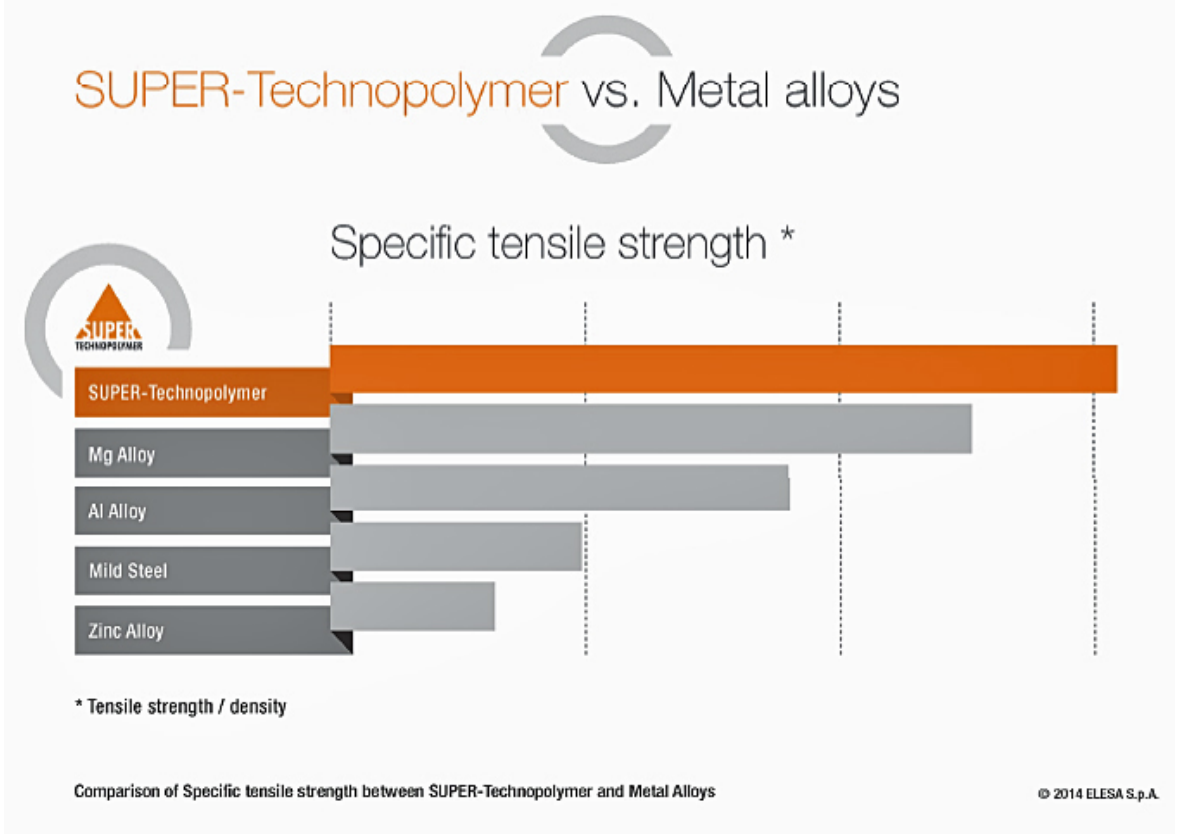
Development of SUPER-Technopolymer as a Metal replacement

"SUPER-Technopolymers" represent the most recent and advanced development in engineering of polymeric materials. Thanks to the presence of high percentages of glass fibre linked to the base polymer with suitable primers and/or the presence of aramid synthetic fibre, SUPER-Technopolymers are characterized by mechanical and thermal properties far superior to the traditional polymers (see chart SUPER-Technopolymer vs. Technopolymer on page 2).

The concept of "metal replacement" is not limited to the use of high-performance engineering plastics. In order to produce technopolymer products for applications which up to now were reserved for metals, it is necessary to bring considerable expertise to the design phase of any such component, so as to ensure the maximum exploitation of all the typical features of polymers, by optimizing shape and thickness in various areas, combined with the benefits of a lower density of material (see chart SUPER-Technopolymer vs. Metal Alloys).



Comparison of Mechanical Properties between SUPER-Technopolymer and Technopolymer



Comparison of Specific tensile strength between SUPER-Technopolymer and Metal Alloys

The use of SUPER-Technopolymers coupled with decades-long experience and expertise at ELESA in the design and moulding of plastic materials, have made possible the creation of an advanced range of components for machines such as hinges, indexing plungers, cam-levers and column level indicators with protection frames which used to be available on the market only in metal alloys. Mechanical and thermal properties, of these products are such as to allow their interchangeability with the corresponding metal products, offering the additional advantages of corrosion resistance and lightness typical of plastic materials.

This is why we can say with confidence that SUPER-Technopolymer components integrate the typical advantages of plastics with some of the strengths of steel and stainless steel.

The additional mechanical strength of SUPER-Technopolymer opens up some of the lighter and medium duty applications once only possible with metal components. The result being that by using a SUPER-Technopolymer the component is more cost effective since this removes a big percentage of the metal content, and so a big part of the cost. Which especially in the case of a previously stainless steel product, leads to a large cost saving whilst maintaining high levels of corrosion resistance.

Main advantages of SUPER-Technopolymers

- **Corrosion resistance:** therefore suitable for use in wet environments or outdoors or on applications requiring frequent cleaning cycles (food machinery, pharmaceutical, etc.)
- **Lightness:** in addition to cost reduction for transport, storage and handling, the lightness of components made out of SUPER-Technopolymer represents a definite advantage for applications on machines or equipment subject to frequent movement or intended for goods handling.
- **Absence of maintenance:** the low friction coefficient of polymers avoids periodic lubrication of the component in particular for those made in self-lubricating plastic material.
- **Non-magnetic:** plastic components are not affected by magnetic fields.
- **Electrical insulation:** preventing the passage of electrical energy through the body of the component. This is a safety factor for all components that can be in contact with the operator's hands.

- **Addition of colour** in the moulded material, offers advantages in terms of quality and duration over painted components (the finish cannot be removed), it also proves economical for reasonable quantities as the cost becomes close to that of standard polymers.

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