axon' cables & connectors

OVERMOLDED INTERCONNECT SOLUTIONS

Expertise

EXPERT IN CONNECTORS AND INTERCONNECT SOLUTIONS

Axon' Cable has developed and manufactured cables, connectors and interconnect solutions for over 50 years. From the manufacture of conductors to connectors and cable assemblies, the company offers custom-designed solutions.

EXPERTISE IN OVERMOLDING

As a protection, overmolding extends the life of cable assemblies and harnesses.

SUMMARY

OVERMOLDING: for an optimal protection

What is overmolding?

The process of overmolding involves joining together a set of parts while guaranteeing mechanical integrity and providing resistance to a variety of conditions such as abrasion, shock, radiation, chemicals, temperature and moisture ingress. The adhesion effect depends highly on the compatibility of the materials chosen. The more the molecular chains are compatible, the stronger the adhesion will be.

Why overmolding?

Overmolding provides robust and tailor-made **mechanical protection** for example for the cable/connector interface which is traditionally the weakest point of cable assemblies.

An overmold can serve many other purposes including:

- Shaping
- Strain relief
- Sealing: airtightness, watertightness
- Absorption of repeated flexes
- Provision of fixing points
- Protection of shielding termination (EMC)
- Improvement of the overall look of the harness

- Space saving with customized shapes
- Easier integration of links or parts into the customer's system
- Customized contact overmolding for higher performance compared to a standardized connector
- Integration of electronic functions (e.g. signal conversion) in cable assemblies
- Customized interconnect solution

Questions to be considered for tailor-made solutions

TECHNICAL REQUIREMENTS

- What is the industry related to the application?
- Which quantity per year or per batch do I need?
- What is the level of sealing needed in terms of dust, runoff, pressure or IP levels?
- Do my parts need to resist sterilisation, autoclave, radiation, or decontamination agents?

ASPECT

- What is the required finish appearance and surface condition?
- Will the overmolded parts be visible?
- Do I have particular requirements in terms of dimensions and tolerances?

ENVIRONMENT

- Which temperature does the part have to resist? Which lifetime?
- Is my system submitted to any particular environmental condition?
- What is the nature of the materials the overmolding has to adhere? cable? connector? contact?
- Are the cable assemblies submitted to dynamic stresses? bending? torsion?

All this data can influence the technological choice in terms of materials or tooling cost.

Co-engineering and process

The co-engineering phase is essential to propose the most suitable and ready-to-use solution.

The key role of co-engineering

The role of upstream co-engineering with the customer becomes essential to select not only the right overmolding material but also the techniques of molding or overmolding. It is, unfortunately, fairly commonplace that the integration of cables and interconnect solutions is not considered until very late in the design process. The installation of the links, which must take into account their passage through contending structures and including changes in angular direction, can therefore be very complex.

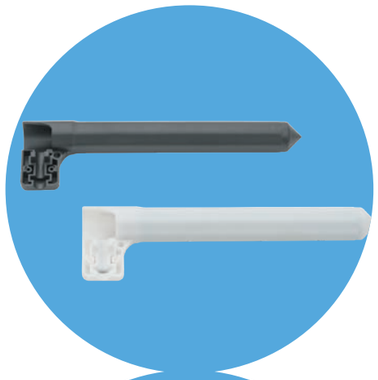
A co-engineering phase is essential to propose the most suitable and **ready-to-use solution**. The choice of overmolding materials must meet the requirements of the specifications, such as flexibility to facilitate the integration of complex shapes or, on the contrary, hardness to resist friction. Abrasion resistance, waterproofing, thermal or chemical resistance can also be considered.

Rheological simulation

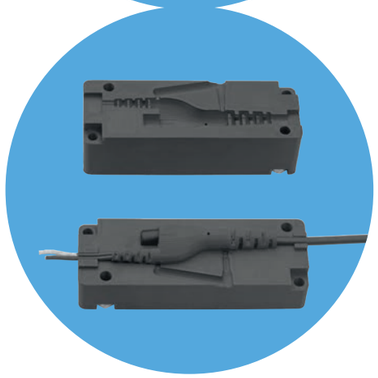
Using software, rheology is the study of the **deformation and flow** of plastic material in a mold. The goal is to optimize the design of molds by anticipating possible defects on the injected parts.
It analyses the filling and pressure of the material in the mold cavity, the compaction and shrinkage of the molded parts in order to determine the best geometry of the tooling and the positioning of the injection points. The visualization of the material flow and the information collected help to limit tooling development costs and reduce design times.

Rapid prototyping

Before production, rapid prototyping is very useful to validate the design and functions of the final part or of the mold. Dimensions, size, and ease-of-integration into the customer equipment are all checked.



Validation of the final part: molded part on the top and 3D printed prototype on the bottom.



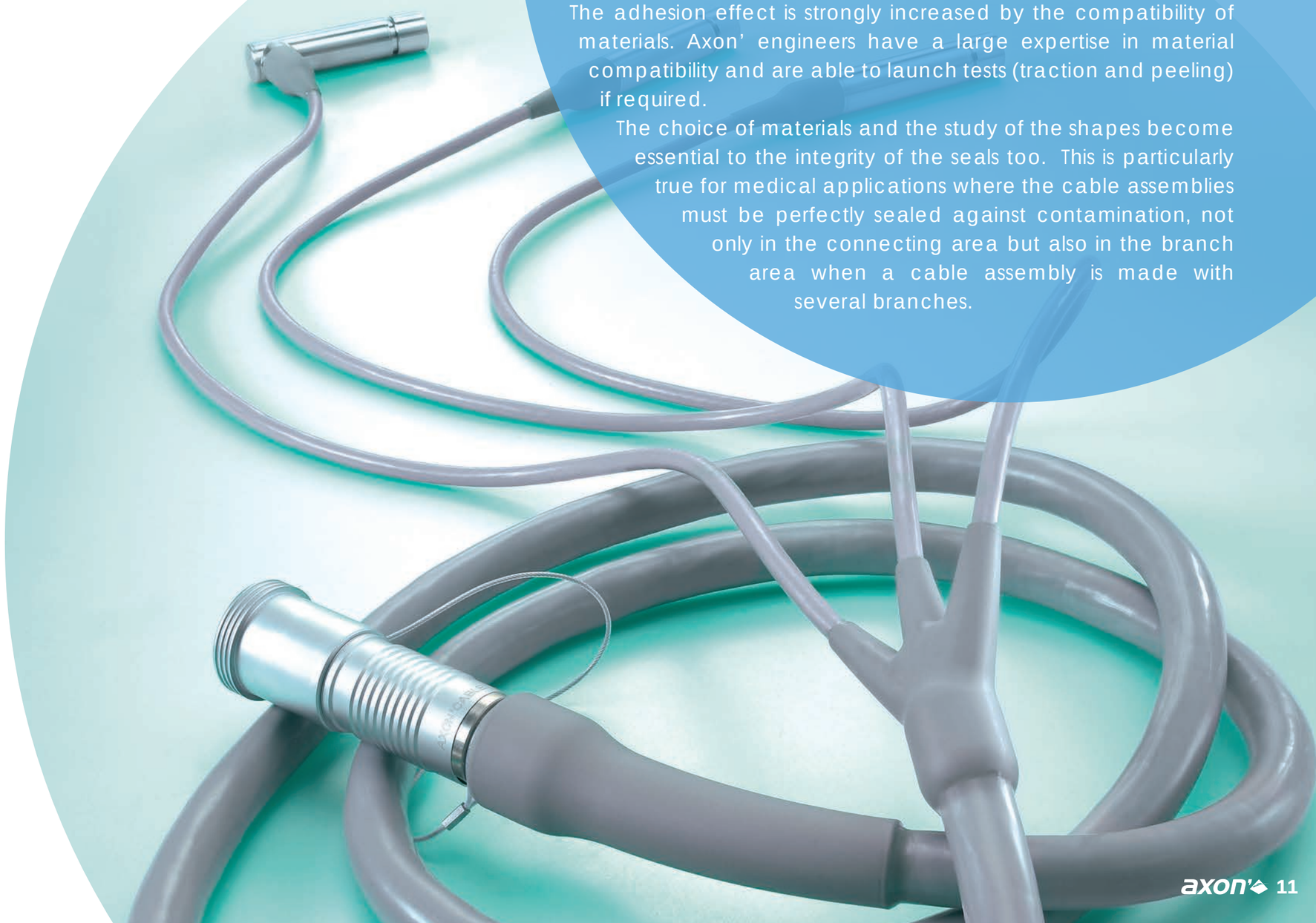
3D printed mold cavities to validate material of the overmolded part.

Materials

How do our engineers choose the right material?

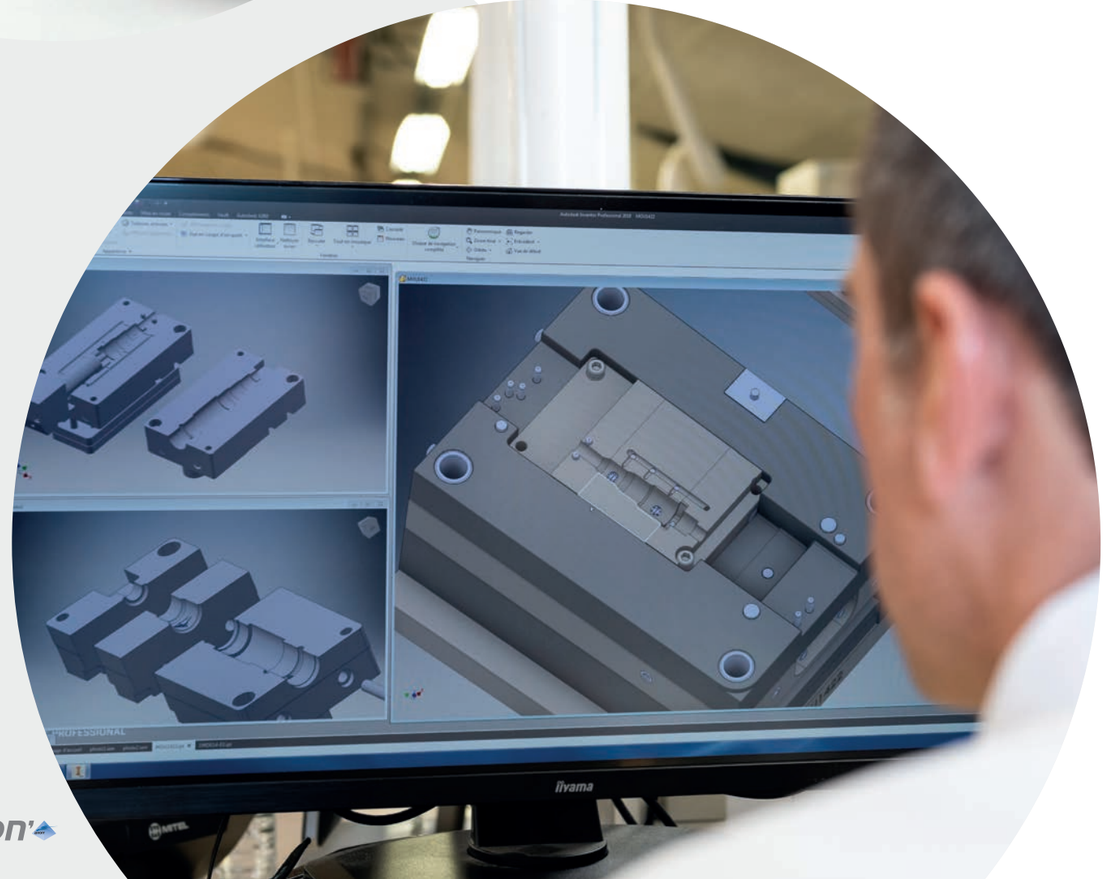
Irrespective of the application, when dimensions require it, or when the environment becomes challenging in terms of pressure, temperature, or gas for example, maximum adhesion is required. The adhesion effect is strongly increased by the compatibility of materials. Axon' engineers have a large expertise in material compatibility and are able to launch tests (traction and peeling) if required.

The choice of materials and the study of the shapes become essential to the integrity of the seals too. This is particularly true for medical applications where the cable assemblies must be perfectly sealed against contamination, not only in the connecting area but also in the branch area when a cable assembly is made with several branches.



Selection of materials

The selection of materials clearly depends on operating conditions and applications of the assembly. If flexibility is a key issue, soft materials with low Shore A hardness such as PVC, and thermoplastic elastomers including TPU, TPC, or TPS will be chosen. When overmolding aims to maintain electrical contacts, PCBs or metal parts, rigid materials with strong Shore D hardness such as PE, PP, PBT, PA, PS, with or without fillers like glass fiber will be the right choice. If thermal constraints are added, high performance materials including PSU, PPS, PEI, or PEEK should be considered.



Adhesion matters!

Adhesion depends on different elements, for example:

The material must be chemically compatible with the support to overmold

The aspect of the surfaces: the more the surface of a part is rough, the better the material adheres

The surface to be bonded: a very small surface will make it more difficult to bond

Surface cleanliness and surface treatment to improve adhesion

The processing temperature of the overmolding:

- Part heating will usually improve the bonding performance (bi-injection technology).
- Material A can adhere to material B but the opposite is not always true when the temperature of material B is lower than A.

Materials and techniques

How do our engineers choose the material for the mold tool?

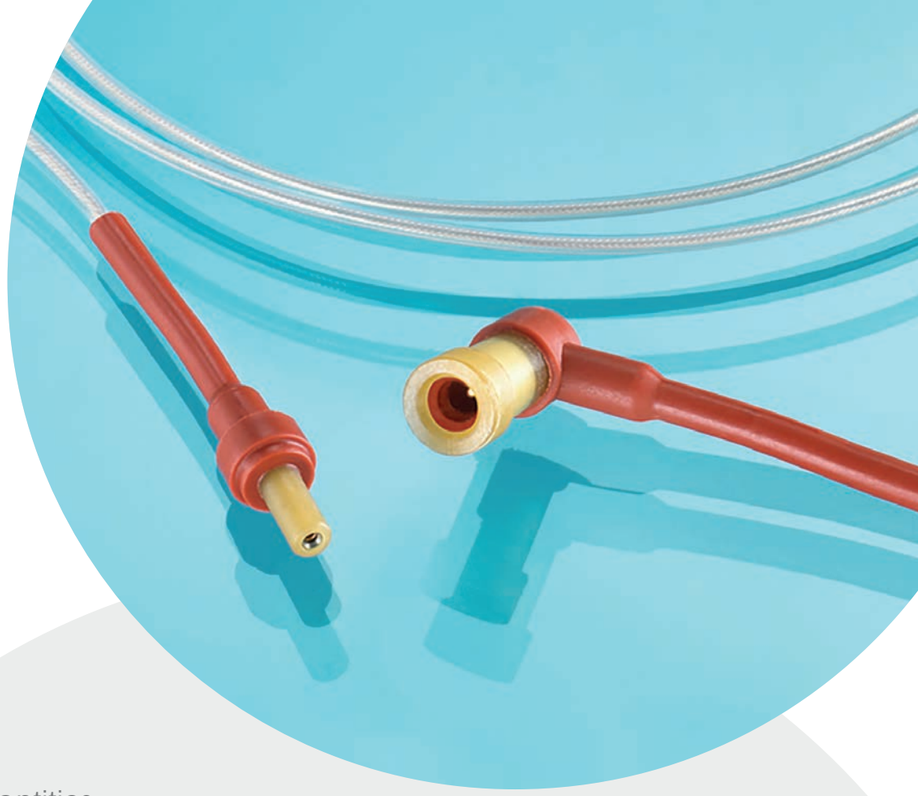
Choice of mold tool material mainly depends on the quantities ordered:

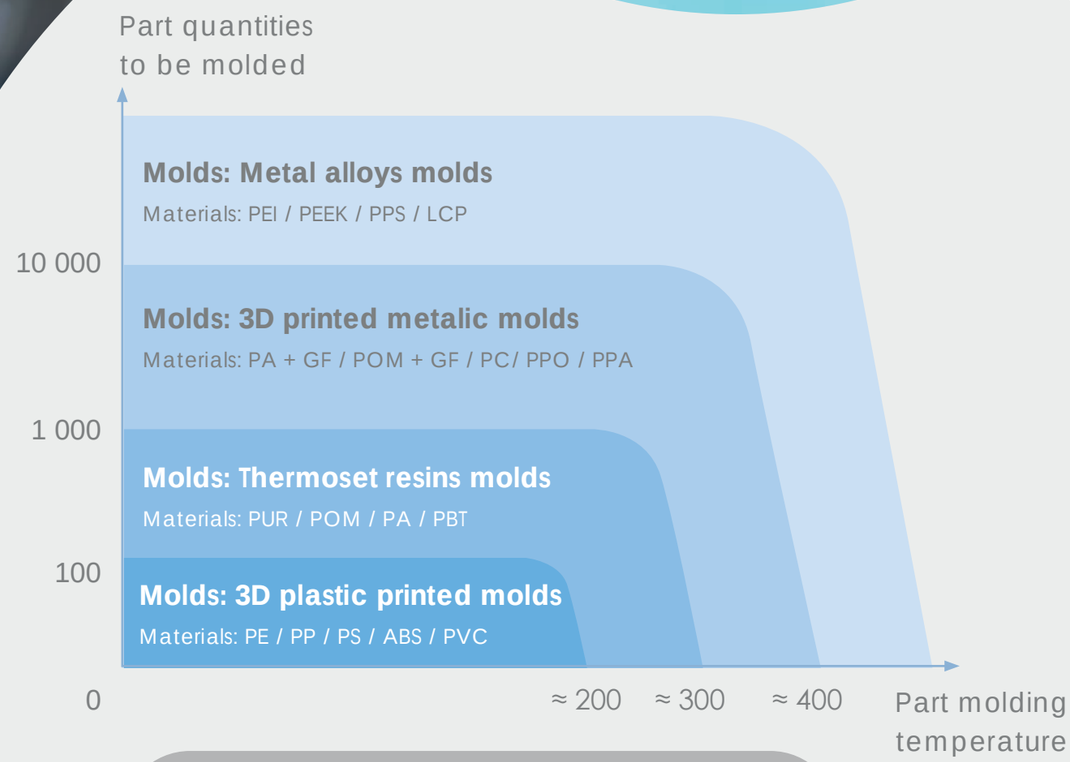
Aluminum or 3D printed mold cavities are usually used for prototypes or small quantities (<1000 pieces).

Steel molds with a hardness of 36/44 HRC are intended for volumes of less than 50,000 pieces.

Steel molds with a hardness of 52/54 HRC are used for volumes of over 50,000 pieces.

The number of cavities will be adapted to the requested quantity and lead-time.





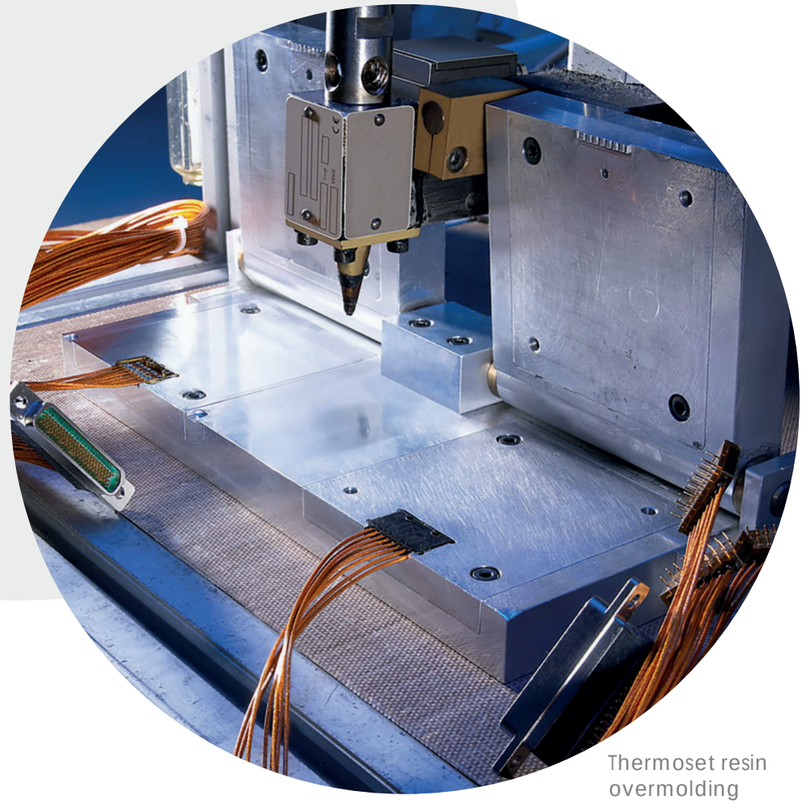
The choice of the mold material depends on the material to be overmolded and the quantity.

Axon’ overmolding techniques

PLASTIC INJECTION

This is the most common overmolding technique: the molten material is injected into a mold which is filled and then cooled, thereby quickly covering and protecting parts placed in the cavities. Material temperature, injection speed and pressure in the mold are all high. This method is therefore not intended for fragile parts. This type of molding method requires specialist machines. AXON’ has a large number of vertical injection press machines which allow for easy placement of the different component parts into the mold cavities. As manufacturing cycles are short, the high pressure technique is suitable for medium and large volumes.

Plastic injection



Thermoset resin overmolding

ELASTOMER AND THERMOSET RESIN OVERMOLDING

This low pressure molding technique consists in injecting a specific material (e.g. Polyurethane, Epoxy, Silicone) enabling simple potting and the formation of complex shapes. The process involves hot or cold curing to transform a mono or bi-component material from a viscous to a solid state. This technique does not entail high pressure in mold cavities and is suitable for small volumes.

Epoxy is currently used for thermal and mechanical requirements, polyurethane offers a wide range of hardness from 70 shore A up to 60 shore D. For easy-to-handle and flexible assemblies, silicone is recommended. Some medical grades are intended for biocompatible (ISO 10993, USP class VI), sterilisable and implantable cable assemblies.

Molded parts

In addition to overmolding, Axon' Cable is able to manufacture molded parts including connector shells, inserts and sleeves. Axon' injection presses are able to manufacture several pieces per minute. The molded parts can weigh from 0.05 g to 80g maximum.

A LARGE EXPERTISE WITHIN THE AXON' GROUP

Other companies of the Axon' group including **Axon' Mechatronics** (industrial connectors and components), **Axon' Nanotec** (miniature parts) and **Addix** (elastomeric components) also have the expertise to manufacture molded parts with different materials and techniques: injection molding, compression molding, transfer molding.

The Axon' group is therefore able to offer a large range of molded products including connectors, seals, elastomeric components and miniature plastic parts.

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