SIMONA.report

Technical Newsletter from SIMONA AG 1/2011

SIMONA® Welding rods

Welding rods tailored to your applications

SIMONA offers welding rods in a wide range of materials and shapes

SIMONA® Welding rods are an important product for tank construction and an integral part of the SIMONA AG portfolio.

SIMONA® Welding rods are manufactured on state-of-the-art production lines. The raw materials used are carefully selected and always of premium quality. The granules are either ready-mixed or fed into the production lines by a gravimetric mixing and metering unit. The materials PE, PP, PVC, PVDF, E-CTFE and PETG are processed to form welding rods with various colours, dimensions and shapes, depending on customer requirements.

In the manufacturing process the pre-dried granules are fed through a barrel by a multi-zone screw. They are heated and homogenised by friction and barrel heaters. Then the extrudate is pressed through the die. This is how the melt is given its final shape. When it has left the die, the continuous extrudate is fed to a take-off unit via a cooling section. When the welding rod has cooled down, it is either wound onto spools (2 kg, 10 kg, 25 kg) or cut to various lengths of rod. All bundles are weighed individually, categorised and packed. Quality assurance is performed daily by the company's own laboratory.

Applications in hot-gas welding

Hot-gas welding is one of the most important and oldest welding methods for thermoplastics. A very wide range of materials are processed such as PE, PP, PVC, PETG as well as the fluoropolymers PVDF and E-CTFE. The areas of use of the various SIMONA® materials are numerous, and they depend on factors such as operating conditions and temperatures, levels of chemical resistance and structural properties.

The methods used most frequently are hot-gas string bead welding (for thin-walled components up to a maximum wall thickness of 10 mm) and hot-gas extrusion welding (as of a wall thickness of 5 mm). They are used to connect sheet blanks for constructing tanks, boxes, ducts, shafts, channels, linings (composite construction) and floor coverings. These methods are also used to connect pipes and piping systems, fittings for exhaust air, waste water

Your contact

Dominic Müller
Diploma Engineer (FH)

Dominic Müller has been working in the Technical Service Center (TSC) at SIMONA AG since 2008. His fields of activity include providing technical support for customers, performing structural analyses of tanks and conducting customer training sessions as well as other training activities in Germany and abroad.

Initially, he completed a three-year course of basic training to become a qualified plastics fitter and then worked as a skilled employee in the field of tank, apparatus and pipeline construction. After that, Dominic Müller took up studies in the field of Plastics Technology/Mechanical Engineering at Darmstadt University of Applied Sciences. Following a work experience programme at SIMONA AG Technical Academy he decided to write his dissertation at SIMONA. When he had successfully completed his course of studies, he finally transferred to the Technical Service Center.

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Page 1 continued

and drinking water, as well as all types of profile.
The SIMONA® range of welding rods covers many different types of geometry in the various materials (see overview).

Fields of application of the various profile geometries

In the case of hot-gas string bead welding as per DVS Guideline 2207-3 a wide variety of profiles are used. Owing to the wide range of available die geometries and in view of its simple handling, it is the most well-known welding method on the market. The most proven method is to use round welding rods. They are used in sizes 3 mm, 4 mm and 5 mm depending on the cubic capacity of the welding joint and the geometry of the welding layer. The seam geometries are V-groove welds, double V-groove welds, bevel groove welds, double bevel groove welds and double fillet welds. Wall thickness is crucial when it comes to welding a seam economically. If the sheet thickness is greater than 10 mm, the method used normally is hot-gas extrusion welding because it is more economical and has a higher weld factor. Weld structure and structural design can be obtained by referring to the DVS Guideline.
In addition, triangular profiles (e.g. TA 80) are used for corner connections. The advantage of these geometries is that only one welding layer is required (depending on material thickness) to fill the welding joint neatly and achieve the required weld reinforcement. Other aspects are the minimal rework required, cost-effectiveness and perfect adaptation of welding joint geometry. A classic example of an application is a folded bracket. When round welding rods are used, at least two to three capping runs are required to fill the joint. This is time-consuming (preparation) and leads to an increase in material consumption. Triangular welding rods make it possible to perform the work more economically because the groove to be filled is only covered with one capping run.
Special types include three-core, oval and two-core rods which are used to connect thin-walled materials without any chamfer preparation (butt joint). They are only rarely used in Europe. The main fields of application are in the USA and Asia.

Range of SIMONA® Welding rods in various geometries

	Round	Triangular TA 90	Triangular TA 80	Three-core	Oval	Two-core
PE-HWU	■	■	■	■		
PE 100	■					
PE-HWST	■					
PE-EL	■					
PE-HML 500	■					
PP-DWU AlphaPlus®	■	■	■	■	■	■
PP-DWST	■	■	■			
PP-EL-S	■					
PP white	■	■	■			
PPs	■	■		■		
PP-C	■	■	■	■		
PP-R	■					
PVC-CAW	■	■	■	■	■	
PVC-MZ-COLOR	■					
PVC-GLAS	■		■			
PVC-C CORZAN Industrial Grade	■	■				
PVC-C CORZAN FM 4910 G2	■					
SIMOLUX (PETG)	■					
PVDF	■	■				
E-CTFE	■					

Influencing factors in welding

- Straightening of sheets being joined
- Standard-compliant chamfering (e.g. 30°)
- Dirt, grease, hand sweat and oxide layers must be removed by machining in order to obtain a high weld factor (scraper, plane)
- Avoid using detergents (acetone)
- Equipment (thermometer, air flow meter, oil and water separators)
- Bear in mind the influence of moisture, and pre-dry the rod if necessary
- To reduce stresses and strains in the welded seam, do not quench sheets but cool them down with air
- Warm the parts being joined evenly

Tips on plastic welding

All welding processes take place when the materials in the boundary areas of the surfaces being joined are in a ductile state. That is where the thread-like molecules of the parts being joined and pressed together link up and entwine themselves to form a homogeneous material bond. Only plastics of the same kind (e.g. PP and PP) can be welded to one another, and within these types only those with an identical, similar or adjacent molecular weight and the same density.

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SIMONA® Eco-Ice®

Product line for ice rinks extended

Ice rinks made of plastic cut costs and raise eco-values. SIMONA® Eco-Ice® plastic sheets for the efficient and energy-saving construction of ice rinks.

SIMONA® Eco-Ice® Ice rink at a Christmas market

SIMONA AG, in conjunction with its Greenice business partner, now offers a new product line in the form of SIMONA® Eco-Ice®. Plastic sheets made of PE are being used to make ice rinks and thus contributing to environmental protection, sustainability and energy savings (see **SIMONA.report 1/2010**). When it comes to investments by city councils and local authorities, the issue of energy efficiency is critical these days. The benefits of plastic ice rinks are obvious: new rink surfaces made out of ultra-smooth plastic sheets offer significant savings on energy and operating costs. In addition, they make ice grooming machines and refrigeration systems superfluous, for unlike conventional ice rinks, cooling pipes for ice production are no longer required. Skaters wearing conventional skates glide directly over the interlocked plastic panels, yet the smoothness of the surface is virtually identical to that of freshly cleaned artificial ice.

Sheet production at the Ringsheim plant

SIMONA® Eco-Ice® plastic sheets are suitable for interior applications and, with UV stabilisation (which comes with a ten-year guarantee), also for year-round outdoor use. Whether it be for ice skating or ice hockey, ice rinks in leisure parks and hotels or for special events and festivities such as Christmas markets – ice rinks featuring SIMONA® Eco-Ice® are already in use at many different sites. SIMONA® Eco-Ice® comes in the following types of polyethylene: PE-HD (heat-resistant), PE-HMW (high molecular weight) and PE-UHMW (ultra-high molecular weight). The SIMONA® Eco-Ice® product innovation received the 2010 German Industry Award and was rated one of the top five in the Energy and Environment category.

Extremely versatile

SIMONA® Eco-Ice® is extremely versatile and easy to work with. The cutting and sawing of tongue-and-groove joints is a completely trouble-free process. SIMONA even offers the option of delivering the sheets ready-cut to the desired lengths.

Continued from page 3

Perimeter boards made out of SIMONA® material

SIMONA® PE FOAM Twin-wall sheets are the ideal material for making perimeter boards that are both break and impact resistant and therefore safer to use. Twin-wall sheets weigh the same as solid ones yet have greater rigidity. In addition, the base material of SIMONA® PE FOAM is light-weight, which makes it easier to assemble and disassemble the panels.

Panels made out of PE FOAM Twin-wall sheets

Modular construction of ice rinks

Another huge benefit of ice rinks fields made out of SIMONA® Eco-Ice® is their modular construction. This makes assembly and disassembly of ice rinks a quick and easy process. The following images show the individual assembly steps:

1) Assembling a timber frame to form the base of the ice rink
2) Laying and interlocking the plastic sheets by using the tongue-and-groove method
3) Installing and securing the panel modules.

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Greenice had its own stand at the ISPO trade fair in Munich featuring an ice rink made of SIMONA® Eco-Ice®.

SIMONA® Eco-Ice®

Key properties

- Excellent glide properties
- Consistent surface quality
- High durability
- Physiologically safe according to BfR, FDA and EU standards
- Good chemical resistance to cleaning agents
- Very versatile and easy to work with
- UV-stabilised (special option with a ten-year guarantee)
- Suitable for use in almost all temperatures

Application areas

- New stadiums and stadium upgrades
- Training areas for ice skating and ice hockey
- Ice rinks for events and festivities
- Ice rinks for theme parks and hotels
- Mobile ice rinks
- Multi-functional use

GREENICE

Business partner Greenice
Planning, design and construction of ice rinks featuring SIMONA® Eco-Ice®

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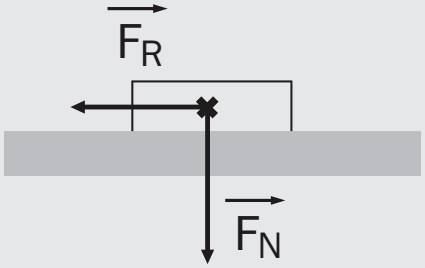
Plastics Expertise

Dynamic friction

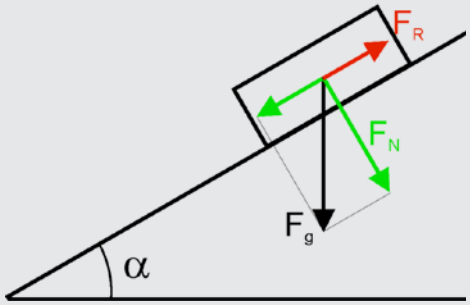
Friction is fundamentally described as the inhibition of a movement that takes place between solid bodies or particles touching one another. A distinction is drawn between internal and external friction. In the following, only external friction will be examined because it is this type of friction that deals with so-called solid friction. It is divided into static friction and dynamic friction. The latter occurs between the surfaces of contact between two bodies touching one another. Both types rarely occur on their own. Usually, static friction has to be prevented at the start of a sliding operation. During the sliding operation it is then different types of friction that have to be examined, e.g. rolling friction, drilling friction and rope friction.
The frictional force F_R increases with normal force (also contact force) F_N. The latter is approximately linear and independent of the size of contact area:

$$F_R = \mu \cdot F_N$$



Source: leifiphysik

The proportionality constant μ (dynamic frictional force or coefficient of friction) is dependent on the nature of the surfaces of the two sliding materials. Dynamic friction force is always less than the static friction force where normal force is the same.
If the planes are at an angle to one another, the weight force of the body and the angle of inclination also have to be considered:



Source: ipf Stuttgart

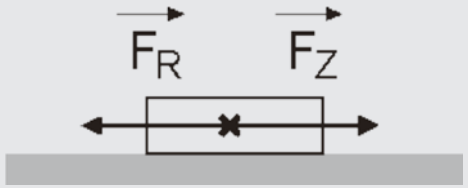
In technical sliding applications an attempt is usually made to minimise the weight forces acting in order to keep the technically produced pressure between the contact surfaces as low as possible. In many cases, the rises in the surface are flattened out by lubricant additives (lubricants) (abrasion and wear are reduced), and this chiefly brings about a reduction in static friction force. Depending on the lubricant additive used, friction between the sliding surfaces decreases (μ is reduced):

Examples using the ultra-high molecular weight material PE-UHMW

Dynamic friction coefficient μ	Type
0.10 – 0.25	Dry running
0.05 – 0.10	Water lubrication
0.05 – 0.08	Oil lubrication

Dynamic friction occurs at the contact surfaces between bodies that move linearly in relation to one another. In the case of some material combinations creep occurs, so frictional force becomes dependent on velocity. Rolling friction is similar to dynamic friction but it is much lower and does not occur when a body slides over another one but when the body rolls over it. Friction is always independent on the surface area in contact.

Dynamic friction force F_R is determined by dragging the body over the supporting surface at a constant velocity.
In this case, the amount of tractive force F_Z is equal to the amount of dynamic friction force:



Source: leifiphysik

Tribology deals with the issue of optimising operations involving friction. Tribology covers the fields of friction, wear and lubrication. It aims to achieve functional, economical and ecological optimisation of moving systems. Use of suitable materials brings about a reduction in the amount of wear and optimises friction conditions.

Various methods are used to measure the amount of wear on different materials. In the case of plastics, the sand-slurry method has become established as an abrasion test. This method makes it possible to differentiate between various types of polyethylene with different molecular weights and their abrasive resistance. This wear test conforming to ISO 15527 is particularly suitable for high-molecular weight materials. The higher the level of abrasion, the higher the loss of material.

Owing to their levels of abrasion and their good sliding properties dehoplast® PE-500 and dehoplast® PE-1000 are ideal for demanding applications, in ice rinks for example (SIMONA® Eco-Ice®).

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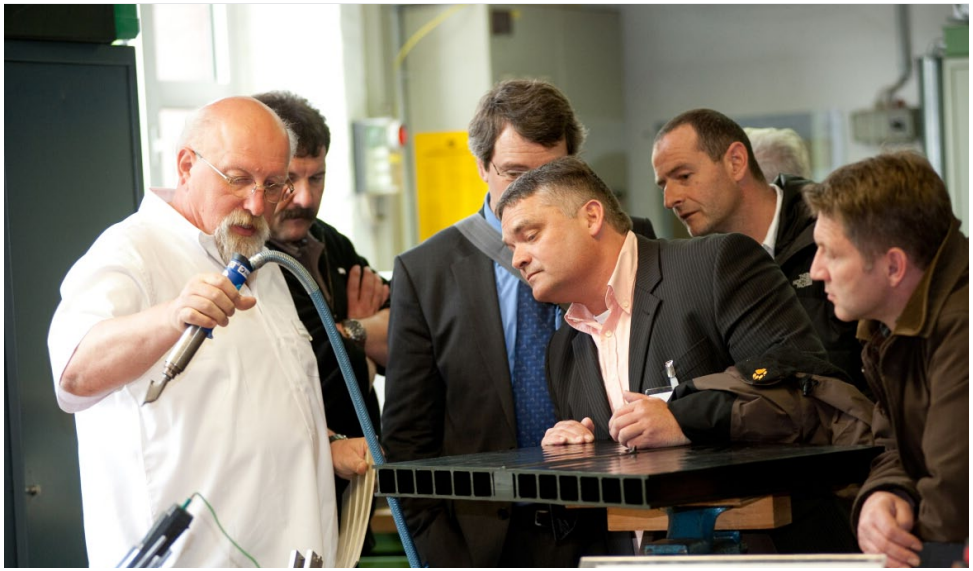
SIMONA Technical Services Unit

Welding “unites” – training and information



A workshop about everything to do with welding.

A welding tool for extrusion welding.

Theoretical lectures are regularly offered in our training rooms in Kirn.

Welding is demonstrated at the Technical Services Unit of SIMONA AG.

In order to meet the quality demands placed on thermoplastic products, plastics processing methods have to be presented in a realistic and practical way.

Whether it’s about the various methods of welding, thermoforming or mechanical processing of SIMONA® Semi-finished products, the aim is always to produce the desired form of plastics. It is the job of the Application Systems team within the Technical Services Unit led by Dr. Marcus Hoffmann to make sure this happens in the interest of all customers. The Technical Services Unit of SIMONA AG also holds customer training sessions on a regular basis. This includes training events held on customer premises, theoretical lectures and customer events like the SIMONA® Colloquium.

To ensure they keep up to date with the latest developments in plastics processing, the team maintains strong links to working networks within the plastics industry. For instance, team members collaborate with many well-known machinery manufacturers and plastics processors so they can identify the latest technical trends in a timely manner and thus provide state-of-the-art information to customers. Due to constant fine-tuning of technical parameters and regular checks conducted by the Technical Services Unit with leading plastics welding tool manufacturers, the parameters specified in DVS standards are always met and constantly enhanced.

You will find everything you want to know about the subject of welding SIMONA® Semi-finished products in our Welding work.info, which can also be supplied in printed form on request.

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