Steel

Product information for aluminum-silicon-coated sheet AS

thyssenkrupp

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Areas of application

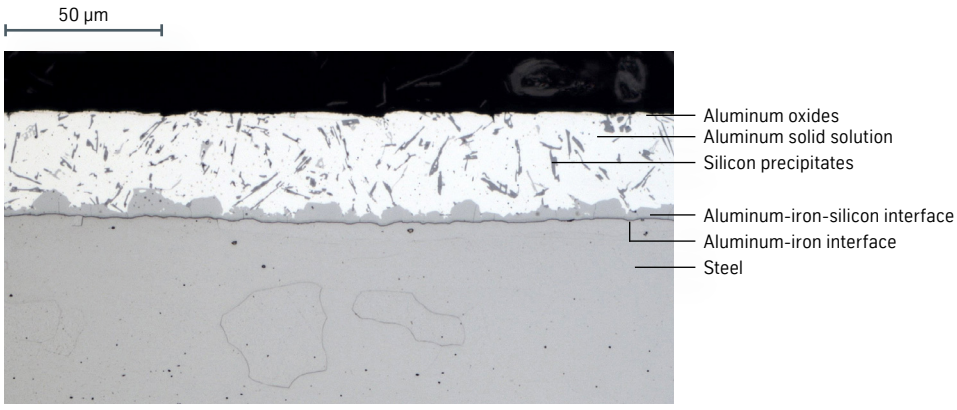
Aluminum-silicon coated sheet (AS) from thyssenkrupp is ideally suited for components that need to resist corrosion at higher temperatures. These include automotive exhaust systems such as muffler casings and pipes, as well as heat shields, exhaust conduits, and gas boiler components.

Thanks to its heat resistance, AS-coated sheet is also suitable for use in household appliances like ovens, deep fryers, toasters, and grills.

In addition, AS sheet is an excellent choice for fuel tanks due to its superior fuel resistance.

Content

Example structure AS-coated sheet



Microscopic formation of AS in vertical polish.

Available steel grades

Like all hot-dip coated sheets from thyssenkrupp Steel, aluminum-silicon coated sheet (AS) is produced continuously in a strip process and coated in an aluminum bath. Typically, the aluminum bath consists of approximately 10% silicon, a maximum of 3% iron, and up to 90% aluminum.

The silicon content can vary between 8% and 11%. In addition to providing excellent corrosion protection, the AS coating offers outstanding heat resistance and high-temperature strength.

Tolerances

The limit dimensions and shape tolerances correspond to the specifications of DIN EN 10143.

Deep-drawing steel

DIN EN 10346	VDA 239-100	Surface finishing AS
DX51D	–	●
DX52D	CR1	●
DX53D	CR2	●
DX54D	CR3	●
DX56D	CR4	●

Hot-dip coated structural steel

DIN EN 10346	Surface finishing AS
S220GD	●
S250GD	●
S280GD	●
S320GD	●
S350GD	●
S390GD	●

Micro-alloyed steel

DIN EN 10268, 10346	VDA 239-100	Surface finishing AS
–	CR210LA	●
HC260LA/HX260LAD	CR240LA	●
HC300LA/HX300LAD	CR270LA	●
HC340LA/HX340LAD	CR300LA	●
HC380LA/HX380LAD	CR340LA	●
HC420LA/HX420LAD	CR380LA	●

● Serial production
AS Aluminum-silicon coated

Detailed information on properties, processing and dimensions can be found in our product information at www.thyssenkrupp-steel.com.

Surfaces

Available surface finishes, hot-dip coated [1]

	Specification	Minimum coating two-sided sample [g/m²]		Coating on each side of single spot sample		Informative
		Triple spot sample	Single spot sample	Mass [g/m2]	Thickness [µm]	Typical thickness [µm]
Aluminum-silicon coated						
Designation						
AS060	DIN EN	60	45		7 – 15	10
AS080	DIN EN	80	60		10 – 20	14
AS30	VDA 239-100	–	–	30 – 65	10 – 20	–
AS100	DIN EN	100	75		12 – 23	17
AS120	DIN EN	120	90		15 – 27	20
AS45	VDA 239-100			45 – 85	15 – 28	–
AS150	DIN EN	150	115		19 – 33	25

[1] Available AS coatings depending on the grade, strip cross-section and surface finish. Further coatings on request.

Surface finishes and surface types

	Finish type	Type of surface	
Product			
Hot-dip coated flat products	Aluminum-silicon coated	A	Normal surface
		B	Improved surface
		C	Best surface

A / B / C as per DIN EN 10346

Surface treatments

Type of surface treatment	
U	Type of surface treatment
O	Oiled
C	Chemically passivated, covex® T
CO	Chemically passivated and oiled
S	Sealed, covex® E

Example of a re-rolled A-surface.

Fine pores or fine uncoated areas (< 1 mm Ø) cannot be avoided. In surface type C, AS-coated sheet is not suitable for use as a visible part in the automotive sector. If the AS surface is to be used as a decorative surface, it must be taken into account that the flower cannot be influenced and is therefore subject to corresponding fluctuations in size and appearance.

Notes on applications and processing

Forming

All known forming processes for cold-formed sheet can be used on AS-coated sheet if the tool geometry and surface are adapted to this material.

The aluminization has a decisive influence on the tribology of the forming process. In particular, the radii of the tools should be polished and a surface finish should be achieved. This can minimize abrasion of the surface and thus reduce the risk of cold welding in the tool.

It should also be noted that aluminum-silicon coated sheet reacts sensitively to tensile-compressive fatigue stress. This must be taken into account when designing the component and planning methods in toolmaking. Additionally, the draw gap and the matrix radius have a significant impact on the formability of the AS coating and should therefore not be chosen too small.

Joining

All thermal and mechanical joining processes as well as bonding and sealing can be used. However, the special physical properties of the aluminum coating require an adjustment of the processing parameters for some joining methods compared to uncoated sheet. It is advisable to use joining methods that are as gentle as possible so as not to impair the corrosion protection.

Processes have been developed that are tailored to the special properties of hot-dip coated sheet. When joining AS-coated sheet with other materials, the potentially different electrochemical behavior must be taken into account, as the corrosion-protective properties of the coating can be impaired by unfavorable metal pairings.

Welding

Due to the strong affinity of copper for aluminum, alloying occurs between the copper material of the welding electrodes and the AS coating during resistance spot and roller seam welding, which complicates the welding process and leads to accelerated wear of the electrodes.

When resistance spot welding, care should therefore be taken to weld with well-cooled electrodes at slightly increased electrode forces using the shortest possible current times in order to reduce the thermal load on the electrodes. The use of a current stepper control has also proven to increase electrode service life. These measures have the effect of extending the intervals for reworking or replacing the electrodes due to wear.

Particularly intensive electrode cooling is required for roller seam welding to reduce the formation of foreign layers on the electrodes. For constant working conditions, the use of a knurled roller drive, the installation of profile rollers or a shearing device is recommended. Roller seam welding with an intermediate wire electrode has proven to be a suitable special process. Here, only the copper wire alloys with the coating instead of the welding roller. However, as the wire is continuously renewed, perfect contact conditions always prevail at the welding point.

The MAG gas-shielded welding process commonly used for uncoated sheet can only be used with restrictions. The heat input must be increased so that the coating is removed before the weld pool due to the heat applied. The welding speed must be reduced to reduce the formation of pores and spatter. Mixed gases are preferable to pure CO_2; damage to the coating next to the seam can be minimized by using short arc and impulse technology.

The most favorable welding results are achieved when welding butt joints using the plasma process. Lap joints are welded with filler wire. Plasma welded joints are characterized by uniform, low-porosity and low-spatter seams. The strength values of the welded joints reach the values of the base material. The seam surface and the immediately adjacent material have no or reduced corrosion protection. In the case of high corrosive loads, the seam area should be protected with aluminum-rich paints.

During laser welding, aluminum-silicon inclusions occur in the seam as a result of the weld pool dynamics, both in butt welds and in overlap seams. The resulting loss of strength of the laser welds must be taken into account, particularly in the case of high-strength and ultra-high-strength grades. If necessary, it is recommended to remove the coating in the weld seam area before joining.

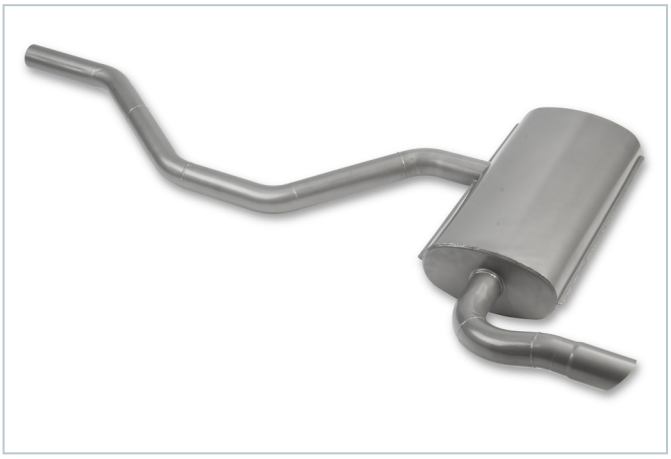
Heat resistance

AS-coated sheet can be used in temperature ranges of up to 700 °C.

Corrosion behavior

Aluminum-silicon coated sheet offers far greater corrosion protection than conventional zinc coatings with the same coating thickness.

Application examples



Automotive exhaust system made of AS-coated deep-drawn steel.

Aluminum-silicon-coated sheet for household appliances, e.g. ovens.

Heat shield in the exhaust system.

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