

Wire arc spraying process for zinc coating of OSB boards

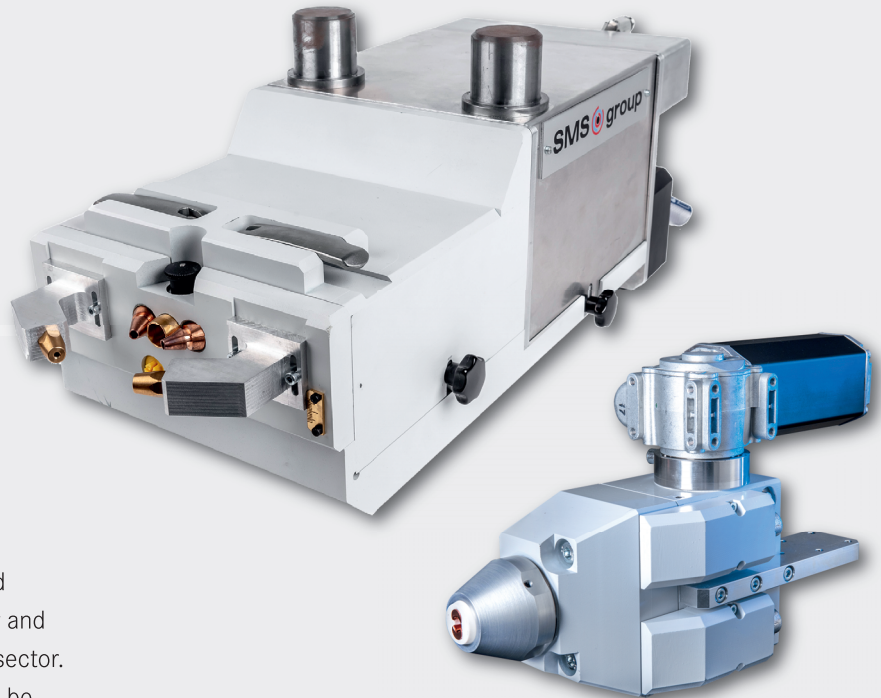
Advantages of zinc-coated OSB boards

- Increased protection against moisture
- Increased resistance to fire
- Shielding effect from electro-smog
- Extended material life

OSB boards: Increased resistance to environmental influences

OSB boards, otherwise known as oriented strand boards, have an irreplaceable function in interior and exterior finishing, especially in the construction sector. The boards are highly resilient and can therefore be used in a variety of ways for cladding the exterior walls of buildings. Further, OSB panels can be combined with other materials and are suitable as a substrate for tiles and other floor coverings.

Due to the basic material of wood, the building sector must overcome the challenges of moisture, rain and fire resistance when using OSB boards. For example, traditional particleboard, such as OSB panels, must be resistant against moisture, particularly when it contacts the ground. In order to extend the material life of OSB boards and to strengthen their protection against environmental influences, SMS group carried out a test on the supporting coating of wood products.



PERFECT jet® 2000 (left) PERFECT jet® 401 (right)



OSB boards as a building material for load-bearing and cladding purposes.

In this context, the process of zinc-coating steel by means of thermal spraying, which has been an established and successful technique used in the metal industry for decades, has now been applied to OSB boards.

The aim is to offer the construction and wood industries new solutions for optimized wood surfaces that meet the challenges of environmental influences, such as moisture and fire. The technology used here is highly efficient and cost-effective arc spraying. The trial and test series carried out by SMS group illustrates the potential for coating OSB boards by means of wire arc spraying.

Zinc offers extensive surface protection for metals

Zinc is a common surface coating used to protect metals against corrosion and/or to increase fire resistance. The protection is achieved through two physical effects.

The first effect is when the zinc passivates/oxidizes on the surface. This zinc oxide layer protects the remaining zinc material against corrosion. Erosion removes the zinc oxide and builds up new zinc oxide. As long as there is a zinc layer on the material, the base material is protected from corrosion. Zinc oxide is particularly effective in increasing the fire resistance of surfaces. This is because zinc oxide only begins to vaporize at a temperature of 1300°C (2400°F), thus protecting the underlying material from the combustion process for longer periods of time.

The second effect is that zinc provides cathodic protection for the metal. This prevents metal ions from being dissolved on the metal surface and corroding the steel.

This raises the question of whether such effects also increase the surface resistance of wood products. The assumption is that these are only partially effective on wood, as the conventional corrosion that occurs with metals does not apply to wood. Nevertheless, the passivated layer protects the basic wood material from environmental influences such as moisture and fire. In addition, the conductive surface offers advantages as regards protection against electromagnetic interference fields, which a wood without this layer does not have.

SMS group tests the resistance of zinc-coated OSB boards

In looking at the application of OSB boards in the construction sector and the resulting material challenges in terms of resistance to moisture, rain, and fire, SMS group investigated the advantages of a zinc coating for OSB boards. In a test of resistance to water, fire, and flammability, the materials specialists at SMS group sprayed zinc on OSB boards.

Test results of resistance to moisture

As mentioned in the introduction, OSB boards are also used for many building interior applications. OSB boards in flooring areas, in particular, must be provided with a moisture barrier. Whether a zinc coating can reliably repel water or only slow down moisture ingress was examined in a test. For this purpose, three samples of OSB boards with different layer thicknesses were exposed to water (see images 1, 2 and 3).



Sample 1 - Image 1



Sample 2 - Image 2



Sample 3 - Image 3

In a 24-hour comparison test, a water column was applied to the surface of the test specimens to simulate standing water. The specimens were weighed and refilled with water at regular intervals. Figures 4, 5 and 6 show the condition of the specimens before water was added. The visible edges result from the sealant used (e.g. plasticizer), which has settled on the zinc.



Sample 1 - Image 4



Sample 2 - Image 5



Sample 3 - Image 6

The subsequent evaluation of the weight gain of each sample indicates that the water gain was limited for sample 1 and 2; see table below.

Sample	1	2	3	Unit
Layer thickness	50	100	200	µm
Sealing	No	No	No	
Weight gain 10h	2	0	10	g
Weight gain 24 h	8	4	31	g
Leak-tightness	Yes	Yes	No	

The slight increase in weight can be explained by the superficial porosity of the sprayed layer. Contrary to expectations, water got into sample 3 and the OSB board swelled. The subsequent investigation showed that in the sample, the surface wood chips were not firmly bonded and the resulting gap was not completely covered by the sprayed zinc.

A long-term test to investigate the resistance to moisture is still pending. However, from the current state of knowledge, it can already be demonstrated that a zinc coating with a low porosity prevents or at least delays the ingress of water.

Test results of resistance to fire

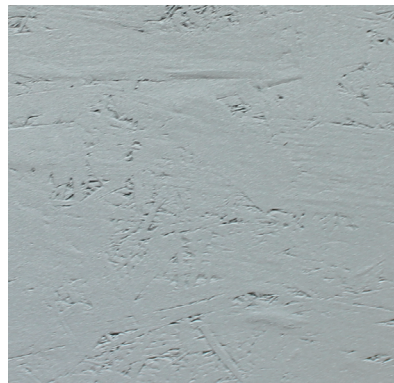
Galvanized steel has a higher resistance to fire than ungalvanized steel due to the zinc oxide layer created (see above). The aim of the test was to determine whether these positive protective properties can also be transferred to wood coated with zinc.

The assumption that the fire resistance of galvanized wood can be increased results from the fact that zinc oxide only begins to vaporize at 1300°C (2400°F). The temperature of the flame is about 1100°C (2000°F). Pure wood without a coating begins to burn at 230°C (450°F). In this context, a zinc coating could increase the wood's resistance to fire.

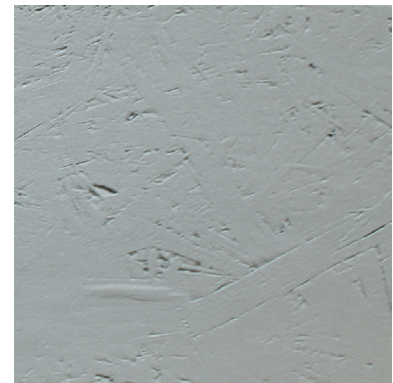
Regarding the experiment: Three OSB boards with zinc coating sprayed on in different thicknesses were continuously flamed locally using a burner. In accordance with fire resistance class F30, the test was limited to 30 minutes. The following figures show the test setup.



Sample 4 - Image 7

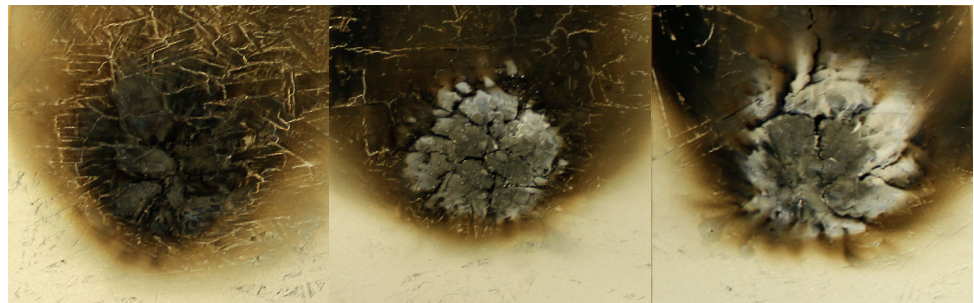


Sample 5 - Image 8



Sample 6 - Image 9

The following figures show the test results.



Sample	4	5	6
Layer thickness	50 µm	100 µm	200 µm
Period	2 min	30 min	30 min
Protection	No	Yes	Yes

It became clear that a zinc coating thickness of 50 µm showed no appreciable resistance to fire. After approximately two minutes, the sample burned independently, without energy input, so that the test was stopped.

The samples with a coating thickness of 100 and 200 µm, on the other hand, demonstrated a resistance to fire. Both samples resisted local flaming for 30 minutes. The clearly recognizable zinc bloom formed in the first few minutes. At the end of the flame treatment, the flame on the specimens also extinguished. In addition, the samples were only warm to the touch.

Although this test does not replace an extensive series of trials, the experts at SMS group conclude that the fire resistance of OSB boards can be significantly increased by spraying them with zinc.

Findings of the test series

A zinc coating with a low porosity can prevent or at least delay water ingress. By applying additional sealants, the effect is enhanced to increase the longevity despite external moisture influences.

OSB panels with a thermally sprayed zinc layer also showed good results in terms of resistance time to flammability. In this test, a layer thickness of 100 µm was sufficient to protect the sample against further burning for 30 minutes.

The shielding effect of electrosmog

Electrosmog is the term used to describe human exposure to electric and magnetic fields caused by everyday objects. This mainly concerns low-frequency radiation fields that occur in mains-powered devices. Protection against electrosmog is of great relevance and will become increasingly important in the future, as people spend large parts of their lives indoors.

Materials that reduce or even shield radiation are therefore particularly important for the building sector. In general, all metals, including zinc, exhibit properties that shield against electromagnetic interference fields. By using walls coated with zinc, it is therefore possible to protect a room or building from electromagnetic radiation. For example, employees in office buildings could be protected from electromagnetic radiation coming from a technical room.

Electromagnetic encapsulation can therefore be used to protect both the residents and the technology and can be used here in a targeted manner.

Increased cost efficiency with wire arc spraying for zinc coating of OSB boards

The tests show that the application of zinc with high-efficiency wire arc spraying optimizes the product properties of OSB panels in terms of resistance to moisture and flammability. Highly efficient wire arc spraying systems are also a convincing solution from a cost perspective.

For a typical OSB board with a size of 3 m², approx. 0.8 to 1.0 kg of zinc is required to produce a layer thickness of 100 µm, depending on the system type and efficiency. For 1,000 OSB panels, this makes a difference of up to 200 kg of zinc savings thanks to the use of high-efficiency wire arc spraying systems.

Production time savings can also be made with such equipment, as more boards can be coated in the same amount of time. SMS group currently offers two high-speed arc spray systems. PERFECT spray® 400 and PERFECT spray® 2000 comprise a power source, wire feeder, and the matching PERFECT jet® 401 and PERFECT jet® 2000 spray heads. While one PERFECT jet® 2000 spray head coats a 3 m² plate in less than one minute, around 8 to 9 PERFECT jet® 401 spray heads would be required to achieve a comparable production time.



PERFECT jet® 2000 (left) PERFECT jet® 401 (right)

Optimizing the surface protection of OSB boards with SMS group

Following the positive results, the coating specialists at SMS group are interested in further advancing the process with partners from the construction and wood industries, or in putting it to use under practical conditions.

Thomas Hohnen, Head of Sales Coating Equipment, at SMS group: "We look forward to discussing this with the relevant experts and are happy to exchange ideas on which variants are suitable and which solutions we can tailor for our customers to meet their individual requirements with our PERFECT spray® wire arc spraying system."

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