

Steel

# MBW<sup>®</sup> AS Pro: The next generation in hot forming

Significantly improved component  
and process reliability in automotive  
engineering.



thyssenkrupp

The innovative alloy concept of the AS Pro coating provides for a significant reduction in process-induced hydrogen absorption during hot forming and protects the component from embrittlement with lasting effect. In a nutshell: highly-reliable component manufacture and minimized risk of failure thanks to MBW® AS Pro.

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# A safety layer like never before: MBW<sup>®</sup> AS Pro

MBW<sup>®</sup> in combination with AS Pro is yet another milestone in hot forming of weight-optimized and crash-relevant structural components in automotive engineering. The alloying of the new coating minimizes hydrogen absorption in the base material during component manufacture by forming a protective shield on the surface. This provides the ideal conditions for an efficient manufacturing process and maximum component reliability.



MBW<sup>®</sup> AS Pro significantly reduces hydrogen absorption in the material



MBW<sup>®</sup> AS Pro increases process reliability in the press plant

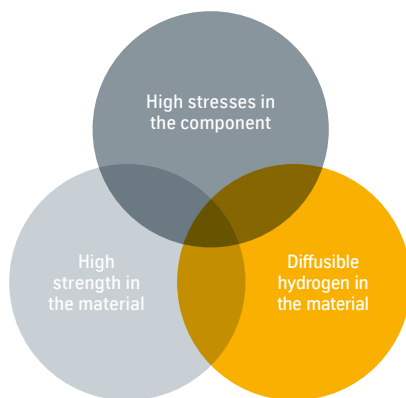


MBW<sup>®</sup> AS Pro enables sustainable cost and energy savings

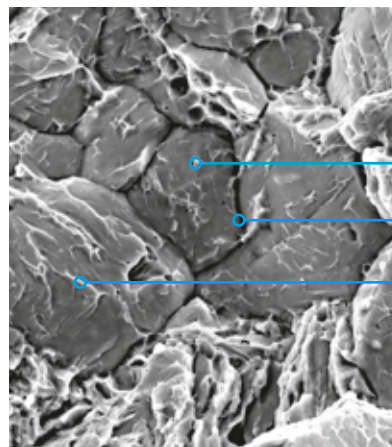
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# The goal: to keep hydrogen out

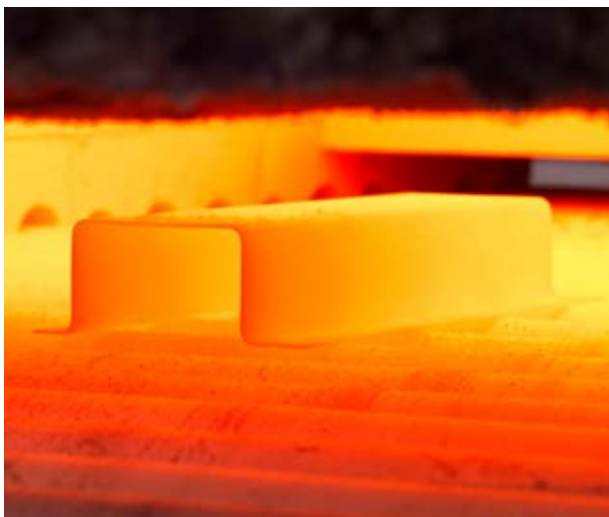
Three factors have an impact on delayed hydrogen-induced component failure



If these three impacting factors are superimposed, the chance of hydrogen-induced cracking is favored, increasing component failure.



Characteristic micrograph of an intergranular hydrogen-induced crack.



Component manufacture by hot forming.

## Process-related susceptibility to hydrogen absorption.

It's no secret: during the hot forming of aluminum-silicon-coated manganese-boron steels, there is a critical phase. During the annealing process and subsequent press-hardening of the blanks, surface reactions occur in the humid atmosphere of the furnace. The aluminum splits the water vapor for the purpose of surface oxidation. In the course of this, hydrogen is generated. Due to the high temperatures involved, the hydrogen – present in atomic form – diffuses into the material via the coating. This process leads to component embrittlement and, if the body-in-white processes are unfavorably designed, ultimately to failure of the component.

Until now the only countermeasures were controlling the furnace atmosphere by means of a dew point control system or subsequent effusion annealing of the component. Both processes are energy-intensive and lead to high costs.

# The strategy: it's all a question of concentration

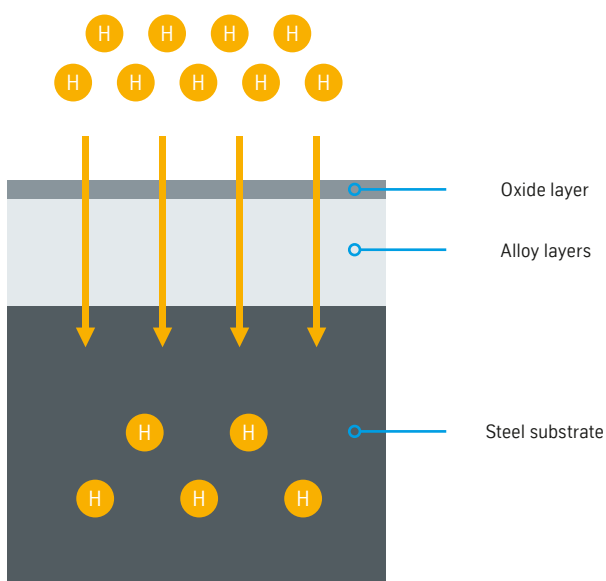
MBW® AS Pro – the next generation of surface coatings for hot forming steels.

The novel chemical composition of the AS Pro coating permanently reduces hydrogen absorption in the component. The way AS Pro works is simple but forceful: the crucial

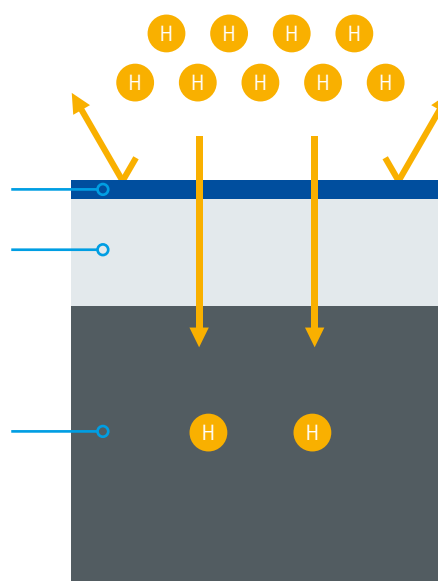
factor is the formation of a thin, but effective oxide layer during the hot forming process. This creates considerably greater and more lasting protection against the accumulation of hydrogen on the surface of the component than is provided by the oxide layer in the standard AS coating.

## Comparison of how standard AS and AS Pro work in the hot forming process

Standard AS



AS Pro



➔ AS Pro offers greater and permanent protection against hydrogen pickup in the component.

# The result: more than convincing

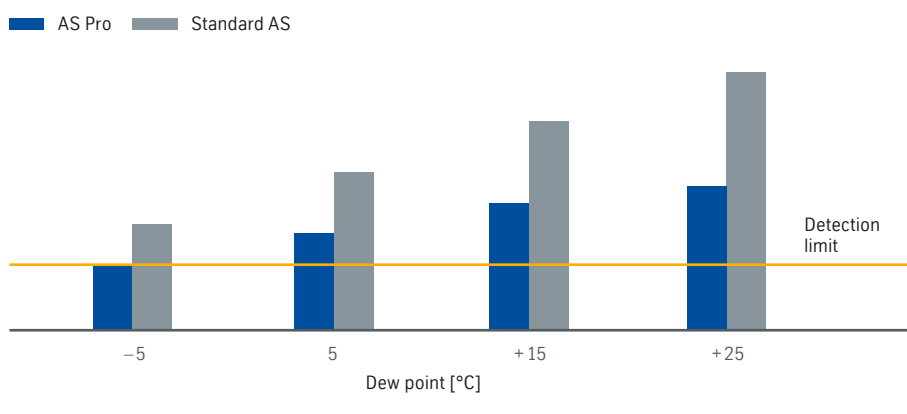
A reduction of 40% or more in the component's hydrogen content after hot forming at dew point temperatures exceeding +5°C has been shown. The positive effects are obvious: thanks to the new AS Pro coating, the hot forming of complex, ultrahigh-strength components is placed on a much more secure basis – decreasing the risk of failure during processing, increasing process reliability, and optimizing manufacturing costs sustainably. And all this without any effect on processing properties: Characteristics such as laser weldability, joinability, friction conditions and paintability remain completely unaffected – no process adjustments are required.

MBW® AS Pro provides comparable processing properties to those of standard AS.

- ✓ Suitability for resistance spot welding\*
  - Welding ranges of equal width
  - High electrode life with >2,000 spots
- ✓ Suitability for laser welding\*
- ✓ Suitability for MIG/MAG welding\*
- ✓ Friction conditions
- ✓ Paintability and corrosion resistance

\* Inspection in accordance with SEP 1220

## Diffusible hydrogen after hot forming of AS Pro and standard AS in comparison



- ⇒ AS Pro reduces hydrogen content in the component after hot forming by 40% or more at a dew point exceeding +5°C.

# thyssenkrupp's comprehensive services help to keep you 100% on track

## Our know-how



Material concept



Surface



Process optimization

As a leading manufacturing technology, hot forming offers potential in respect of cost and weight reduction in automotive engineering – but at the same time requires know-how in production and machining processes.

As a partner for the hot forming process, thyssenkrupp offers not only the appropriate material concept and surfaces, but also the facilities that enable you, for example, to determine the optimum hot forming process parameters.

## The benefits to you



Cost reduction



Weight optimization

These facilities include our own testing area containing state-of-the-art hot forming lines; this enables production processes to be reproduced on a laboratory scale. In this way vehicle development – from component design to production – can be supported extensively with analyses relating to press plant processes (thermography, deformation, simulation) and troubleshooting. In addition, processes, component feasibility and microstructure can be examined by means of FEM simulations at thyssenkrupp.

As a result, our services lead to a holistic understanding of materials and manufacturing and open up interesting prospects for our customers when it comes to developing innovative solutions.

engineering. tomorrow. together.

## Steel

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