Ceramic surfaces for wear and corrosion performance
TRD Surfaces offers hardening technologies with an unrivalled wear performance compared to conventional bulk surface hardening treatments, such as case hardening, nitriding and hard chrome plating. Through our innovative gas-based processes, chromium atoms are incorporated into the surface where they react with carbon atoms from the steel, creating an extremely hard ceramic carbide surface.

The hard carbide layer is grown from within the material, resulting in extremely good adhesion – thus minimizing the risk of spallation.

The TRD processes provide surface treatments that will drastically increase your components wear resistance. Our processes are optimized to offer you extremely hard and uniform surfaces that tolerate all kinds of wear. The surfaces will be tailored precisely to your needs, whether the wear is abrasive, erosive, galling or even corrosive in nature.
TRD Chromium Carbide (CrC)

The chromium-based treatment will serve as a versatile protection against abrasive, adhesive, erosive and corrosive wear.

A layer of corrosion and wear resistant chromium carbides is grown at the surface, providing both chemical and mechanical protection.

Its corrosion resistance is comparable to hard chromium, while at the same time being twice as hard (up to 2000HV).

At higher temperatures, chromium carbide layers exhibit excellent oxidation resistance due to their capability of forming protective Cr-oxide layers.

If needed, the carbide layer can be polished to lower roughness values than described in the data overview.

Typical applications are various steel bushes, pins, guides, nozzles and many more.


<table>
<thead>
<tr>
<th>DATA</th>
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<tbody>
<tr>
<td>Carbide</td>
<td>(\text{Cr}_7\text{C}<em>3) and (\text{Cr}</em>{23}\text{C}_6)</td>
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<tr>
<td>Hardness</td>
<td>1600-2000HV</td>
</tr>
<tr>
<td>Thickness</td>
<td>3-30(\mu\text{m}), (\pm 1\mu\text{m})</td>
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<tr>
<td>Typical (R_a)</td>
<td>0.3-0.6(\mu\text{m})</td>
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When comparing TRD CrC to conventional bulk hardening treatments such as hard chrome plating and boronizing, the wear performance is improved considerably.

Micro Wear Test (MWT) using quartz as abrasive media. The tool steel was alloy AISI O1. Measured values are abrasive indices, corresponding to a wear depth per wear distance.

Wear resistance of hardened tool steel is **improved by a factor 13** by using the ceramic TRD CrC technology.

### Developing the optimal solution

TRD Surfaces conduct development projects in close collaboration with customers. Every application has its own set of wear challenges and we see ourselves as a valuable partner in making the best solution in close collaboration with the customer. A development project could be the exploration of the use of TRD CrC or other surface layer carbides for customer-tailored applications. TRD Surfaces is also capable of producing single or mixed carbides of vanadium, titanium and niobium, with the possibility to obtain hardness values up to 3800HV.
Strengths of TRD

The novel TRD technology is gas-based, providing no restrictions on the geometrical shape of treated parts. We process the parts as bulk, ensuring easy and fast handling with repeatable results, batch after batch. The unique growth mode, ensures a maximum adhesion between carbide and steel.

TRD Surfaces is capable of treating both smaller and larger volumes of components, ranging from test trials to full scale production. If a high strength of parts is desired, core hardening shall be performed after TRD treatment.
The TRD technology is applicable for all carbon-containing steels, and our experts are ready to guide and determine the best solution for your applications. Below are a few examples of materials shown.

- **AISI O1 / 1.2510** Low alloy tool steel
- **AISI 1045 / 1.0503** Medium-carbon steel
- **Vanadis 6 PM tool steel**
- **1.2063** Cold work steel
- **AISI 51200 / 1.3505** Bearing steel
- **AISI M3:2 / 1.3395** High speed steel
- **D39** Traditionally sintered steel
- **AISI HNV3 / 1.4718** Stainless steel
- **GGG50** Cast iron
TRD processes are founded on years of research and development. They are gaseous processes and will harden the surface of your components by growing a layer of hard carbides.

The obtained surface layer is a well-adhering layer that is an extension of the material itself. The layer is both mechanically as well as chemically bound to the treated component, resulting in maximum adhesion.

The treatments are versatile, flexible, and due to the gaseous nature of the process, complex geometries can be treated.

Every application has its own set of wear challenges and TRD Surfaces sees itself as a valuable partner in making the best solution in close collaboration with the customer.

Employ a TRD Technology today and get increased lifetime, enhanced reliability, lead time reduction and a higher overall equipment efficiency.

TRD technology ...

... ensures the highest surface hardness of any bulk hardening process - many times harder than traditional heat treatments and case hardening

... is a cost-effective batch process for handling thousands of parts at a time

... delivers a high reproducibility and is a robust technology

... provides better wear resistance than any electrochemical process such as hard chromium plating

... covers all surfaces of your component, producing a uniform, controllable thickness of up to 30µm

... has so far shown to improve the lifetime of critical components of up to 17 times!