

Manufactured in Germany

ROHDE

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Rox-free

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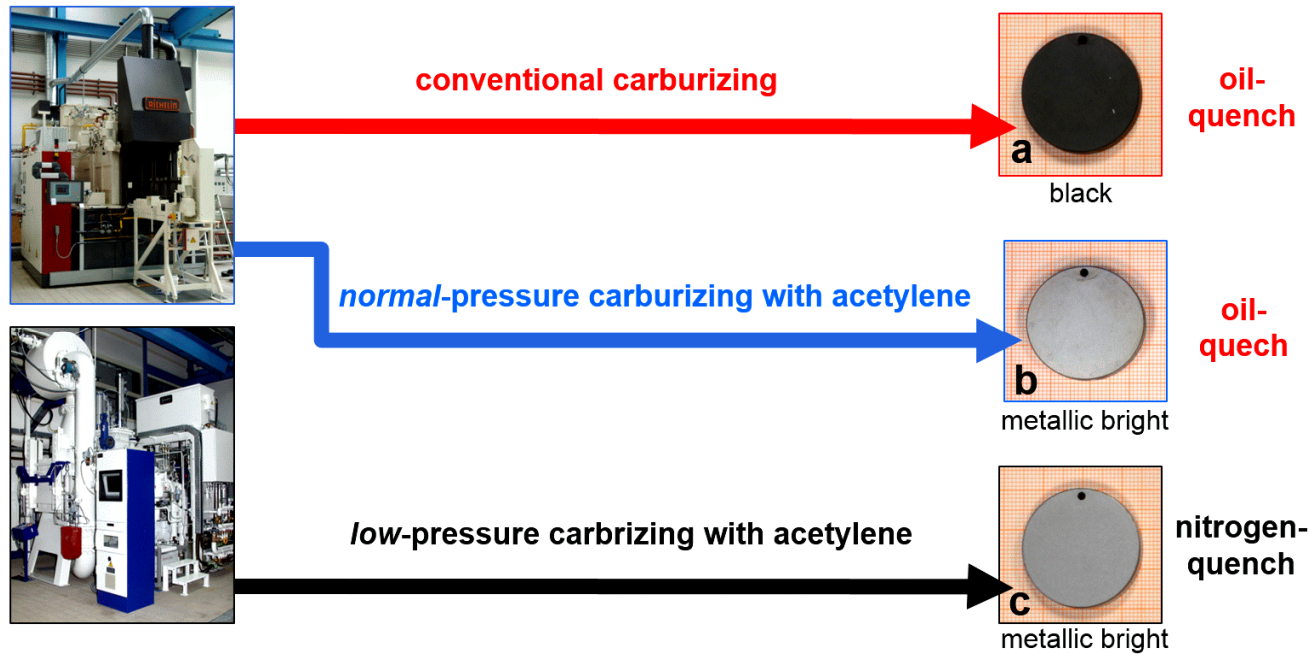
Rox-free – Gas carburizing at atmospheric pressure without surface damage

At first glance, the heat treatment specialist may think, there must be a contradiction or a misprint embedded in the statement of the title. This is actually not the case. For many years experts from industry and university worked in order to make the controlled gas carburizing precise and reliable. The success was outstanding: by means of an oxygen probe a C level can be controlled and regulated. Together with the diffusion calculation a defined carburizing depth as well as surface carbon content can be set precisely. Unfortunately, the established gas carburizing procedure has the disadvantage that for control reasons one can work only in carburizing atmospheres, which contain oxygen. That leads inevitably to a damage of the component surface in the form of surface oxidation.

Joint research project of ROHDE Schutzgasöfen und Foundation IWT Bremen

In a joint research project, ROHDE Schutzgasöfen GmbH and the Foundation IWT Bremen systematically investigated carburizing gases, which could reduce or avoid the surface oxidation completely. In order to suppress damage by the effusion of manganese and also to keep investment costs low, research has been conducted specifically at atmospheric pressure with an gas-tight Amulti-purpose Aichelin chamber furnace (1100 x 600 x 650 mm, max. 650 Kg) with an integrated oil quench tank.

The heat treatment results in the industrial plants offer a promising perspective. With pulsed atmospheric nitrogen-acetylene processes 1 mm CHDs were reproducibly accomplished with 18CrNiMo7-6 (1.6587) avoiding surface oxidation almost completely. The picture below shows a visual comparison of probes after the different hardening processes. The conventional carburized and the Rox-free normal pressure carburized probes were case hardened in the same furnace and in the same oil!

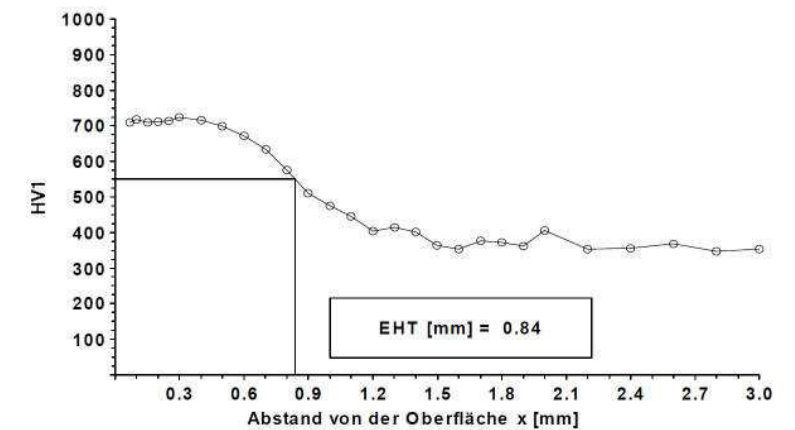


Visual comparison of probes made of 18CrNiMo7-6 after different case hardening process: a) conventional gas carburizing with quenching in oil b) Rox-free normal pressure carburizing with acetylene and quenching in oil, c) low pressure carburizing with acetylene and quenching with nitrogen gas.

The procedure opens the possibilities to case-harden components without surface damage up to large CHDs: no surface oxidation, no manganese effusion, and no carbide precipitation. This automatically leads to higher component quality and in many cases surely to increasing component lifetime. Even the so possible elimination of the final hard machining of components or avoiding of overheating when grinding can contribute to further increase of the efficiency.

Rox-free – Industrial implementation

Now the process is successfully implemented with a Rox-free-Control unit at an industrial Ipsen RTQ (910 x 1220 x 1010 mm, max. 1500 Kg). The left side of the picture shows the installed Rox-free-Control unit and on the right side the accomplished distribution of hardness in the distance to the surface of a hardened and tempered part.



The Rox-free method was presented at the HK2012 in Wiesbaden, Germany in the presentation of Mr. Bischoff, et al. and published in HTM J. Heat Treatment Mat. 68 p. 199-206 "Gas aufkohlen unter Normaldruck und ohne Randschichtschädigung – erste Ergebnisse / Gas carburizing at Atmospheric Pressure without Surface Damage – First results"

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