Crankshafts

Nitriding

Crankshafts are both subject to fatigue and wear. To meet these demands they are often produced from steel that has been designed for nitriding. The objective is to provide a material that will nitride in a cost effective way and give good surface hardness coupled with a good supporting base material.

The oldest and most well known UK specification is EN40B now called 722M24 and another alternative might be 897M39.

Where 'clean steel' is a pre-requisite then the most commonly used material is S132. Other grades are available where companies have developed specifications to overcome specific problems associated with either mechanical properties or processing. OvaX 200 is our advanced material to meet this need.

OvaX 200

Today at Ovako we have designed a modern alloy steel alternative specifically developed for nitriding. OvaX 200 is a perfect steel for plasma, gas or nitro-carburising.

The material has been designed to give:

- High Cleanliness
- Slow Air Cooling
- Very Low Distortion
- Reduced Grinding and Finishing
- Temper Resistance
- High Operating Temperature

Chemical composition

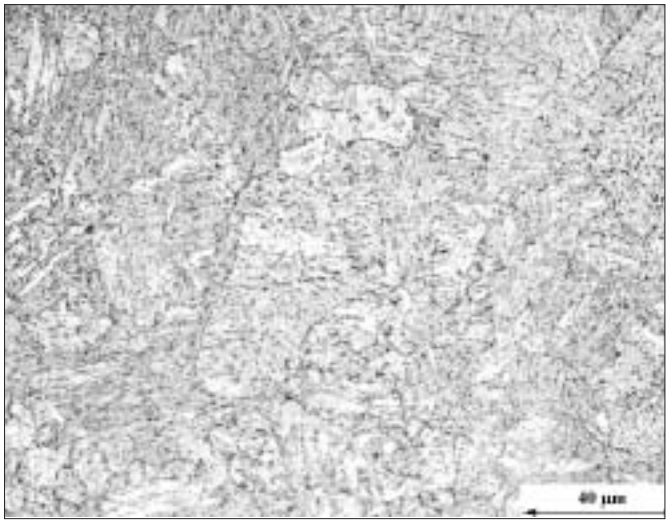
Element	C	Si	Mn	P	S	Cr	Ni	Mo	V	O	Ti
Min.	0.14		1.20			2.10	0.45	0.45	0.15		
Max.	0.17	0.15	1.40	0.020	0.003	2.30	0.55	0.55	0.25	9 ppm	30 ppm

Delivery Condition & Machining

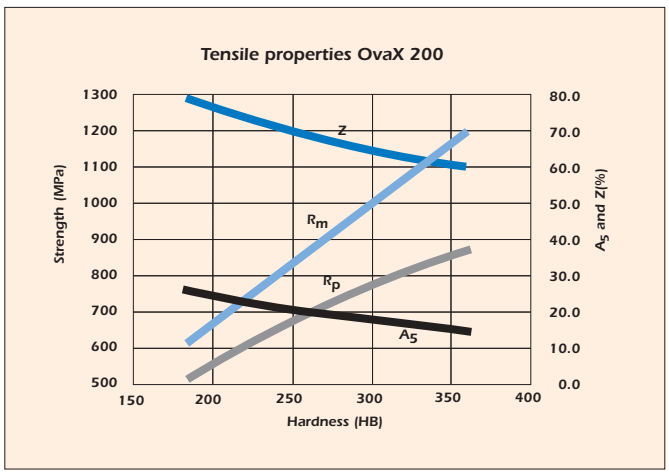
We do not normally recommend that the material be delivered with a conventional hardness of between 190-220 HB. While the material will be very suitable for cold or warm forging the structure will be too tough for normal machining since it will have an impact strength of 240 J.

The material is naturally produced with a hardness of approximately 350 HB. The material is in an air quenched & self-tempered condition with a martensitic structure but is capable of being machined directly with standard coated carbide cutting tools.

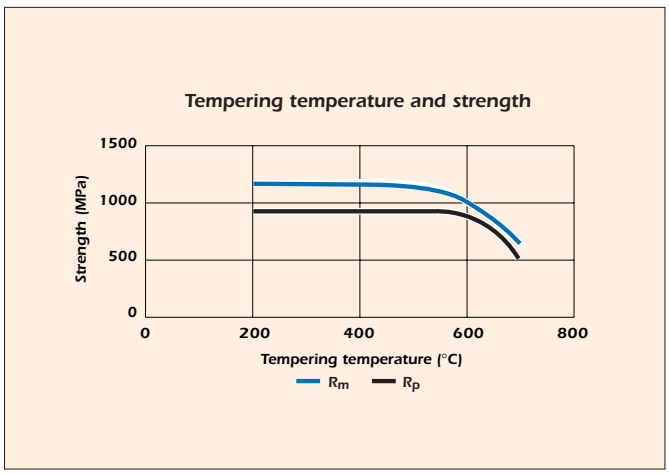
The steel can easily be tempered back to a hardness of between 270-300 HB and can be machined with conventional tooling quite easily at this hardness due to its good structure.



Tough tempered OvaX 200.



Tensile properties as function of hardness.



Tensile strength as function of tempering temperatures.

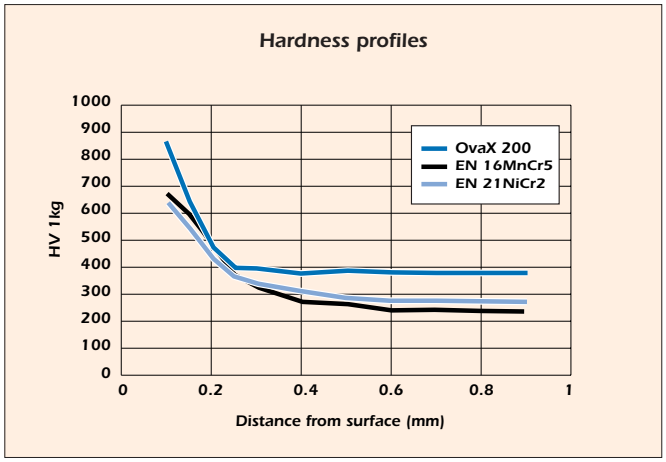
After machining OvaX 200 can be either conventionally hardened and tempered or air-hardened and tempered to give a hardness of about 350 HB. The low distortion characteristics will be lost by conventional hardening since the distortion is primarily a function of quenching speed. Tempering should be made at a temperature of 10° C above the nitriding temperature.

Nitriding Processing

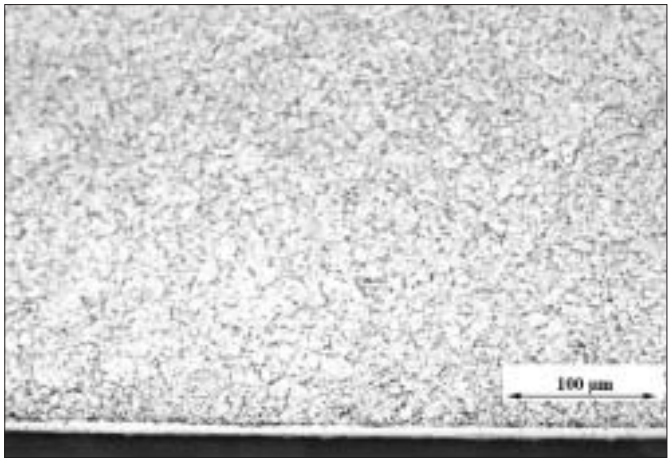
The nitriding process is used on OvaX 200 to give a surface hardness of about 850 HB with core hardness levels of between 350-400 HB. The time taken is usually about 20 hours but can be extended if deeper hardness levels are needed.

Nitriding of OvaX 200 can be easily undertaken using either gas or plasma and the process temperatures used are normally at 490° C or 510° C respectively. At this temperature the base material will retain its original properties.

Gas Nitriding

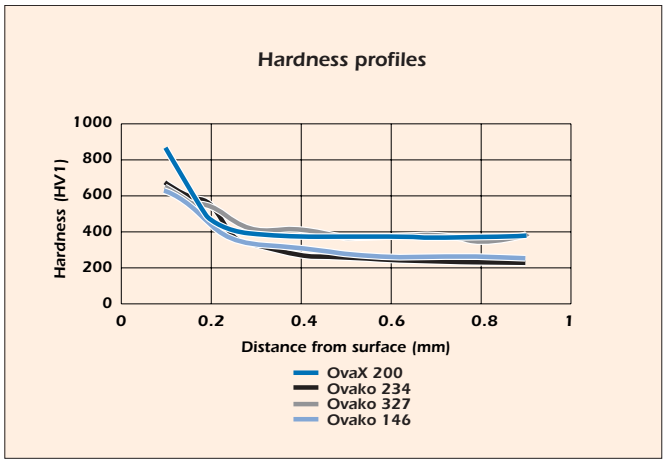


Hardness profiles after gas nitriding of OvaX 200 and two conventional carburising steels.

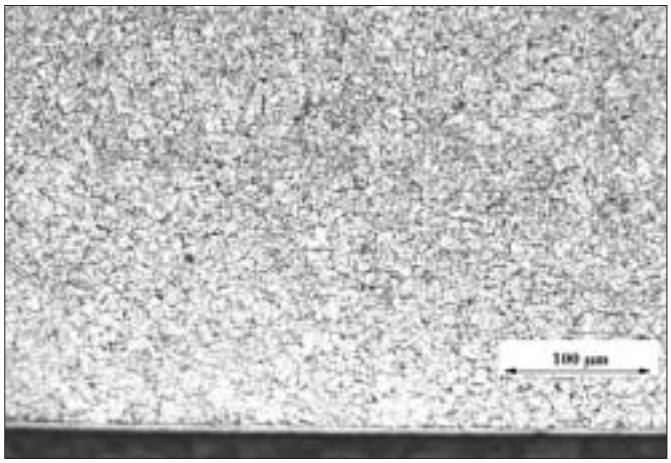


The microstructure of gas nitrided OvaX 200. The core is tempered martensite and then a diffusion zone and closest to the surface is the compound layer.

Plasma Nitriding



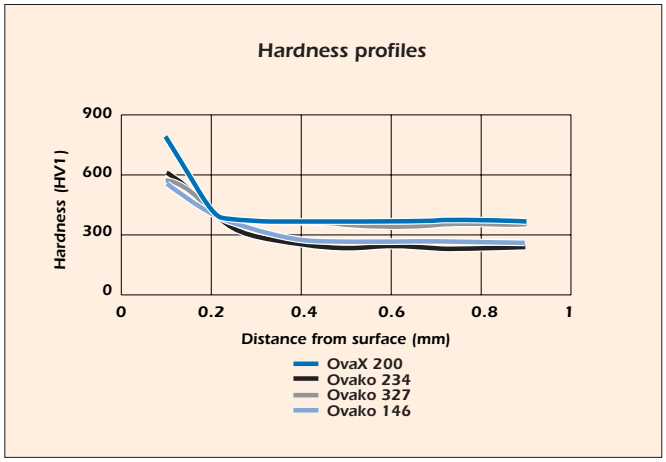
The hardness profiles after plasma nitriding of OvaX 200 and some conventional steels.



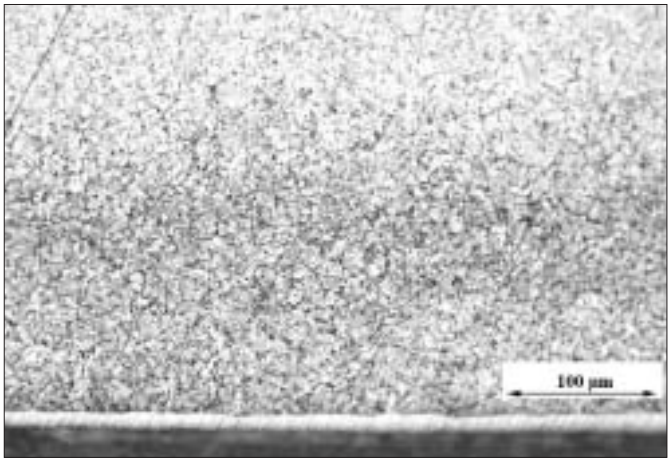
The plasma nitrided microstructure of OvaX 200.

Nitrocarburisation

If nitrocarburising is the favoured route then the higher processing temperature of about 570° C might have a very slight effect on the overall strength but the structure will be good.



The hardness profiles after nitrocarburising of OvaX 200 and some conventional steels.



The nitrocarburised microstructure of OvaX 200.

OvaX 200 is a superior steel well suited to the demands of carburised components where high cleanliness is an integral element in the performance profile. In addition the control of distortion offers excellent processing properties and the material gives improved high temperature operation.

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