Application Case Study
Surface Treated Steel

Prepare High Quality Samples in Minutes Using the PlanarMet™ 300 Planar Grinder and EcoMet™/AutoMet™

Background
Surface treated steels require consistent and efficient sample preparation for production quality control environments. Material flatness and consistent removal rates are critical to ensure repeatable results. Surface planarity and rapid material removal is achieved with the PlanarMet 300 for surface engineered steels. A new preparation method has been developed for microstructure investigation and hardness testing of hardened C45 steel, hardened and nitrided C15E steel.

Preparation

Mounted specimens clamped in a central force holder.

Nitrided layer. Diffusionzone after etching with 3% Nital. Magnification 100x.

Heat treated steel C45, hardened, surface decarburisation. Etched with 3% Nital. Magnification 200x .

Sectioning

Equipment: AbrasiMatic™ 450
Consumable: Abrasive wheels for medium hard ferrous materials

Samples of the hardened zones are sectioned for further mounting processes. Serial cutting can be performed on different locations.

Mounting

Equipment: SimpliMet™ XPS1
Consumable: EpoMet F

Samples are mounted in EpoMet compression mounting compound. Nitrided samples are covered in aluminum foil before mounting to protect the nitrided layer from damage during the preparation.

Grinding & Polishing

Equipment: PlanarMet™ 300

The initial grinding step is carried out on the PlanarMet 300. Preparation is fast and produces exceptionally flat samples.

Parameters:
Grinding setting:
Load: 40.5 lbs [180N] *(for six samples)*
Cycle time: 1:10 Minutes
Head RPM: 120
Platen: Contra
Wheel Type: Aluminium oxide wheel, 120 [P120] grit

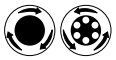
The initial grinding step with a 120 [P120] grit alumina stone will lead to significant material removal and a defined surface finish for the ongoing preparation steps. This will reduce overall preparation time by best preparing the specimens for the next steps.

Equipment: EcoMet™/AutoMet™ 300

The Ecomet/AutoMet 300 was used to polish the specimens using a 12in [305mm] platen. The mounted specimens were polished in central force mode with only two steps.

Preparation (cont'd)

3-Step Method for Medium/Hard (<35HRC) Ferrous Materials using the PlanarMet™ 300 and EcoMet™/AutoMet™ 300

Surface	Abrasive / Size	Load - lbs [N] / Specimen	Platen Speed [rpm]	Head Speed [rpm]	Relative Rotation	Time [min:sec]
Alumina Grinding Stone	120 [P120] grit	7 [30]	Fixed	120		1:00
Apex™ Hercules S	9µm MetaDi™ Supreme Diamond*	7 [30]	150	60		4:00
VerduTex™/ MicroFloc	3µm MetaDi Supreme Diamond*	7 [30]	150	60		4:00

● = Platen ❁ = Specimen Holder *Plus MetaDi Fluid Extender as desired

Analysis

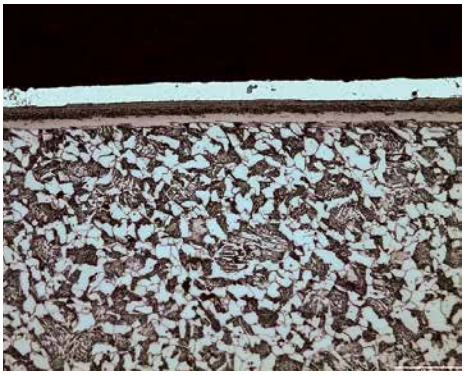
Imaging & Analysis

Equipment: Nikon Eclipse MA200 Inverted Microscope

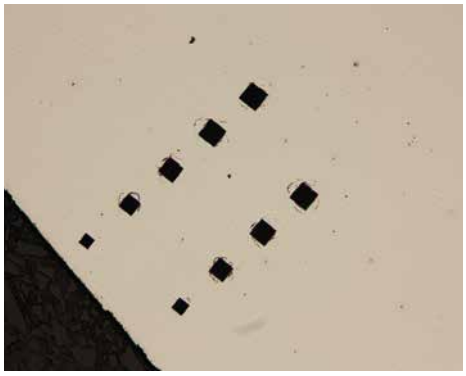
The prepared specimens were inspected at magnifications between 50X and 200X at the eypiece on a Nikon Eclipse MA200 compound microscope equipped with a 3.1MP UEye digital microscopy camera using bright field illumination (BF).

Hardness Testing

Equipment: Wilson® VH3100
Indent Type: Vickers



Porous and nitrided layer layer after etching with 3% Nital.



An NHD measurement was carried out on the nitrided steel to check the nitrid-hardened depth on the gear wheel.

Conclusion:

A good surface finish was achieved after PlanarMet 300 grinding stage in less than 2 minutes. No additional coarse grinding steps were required and excellent flatness was acheived on the specimens. Final polishing steps involved a 2-step procedure with the resultant finish faintly showing the grain structure viewed under brightfield microscopy.

Benefits:
Traditional preparation routes are arduous and take longer times. To mitigate this, Buehler has developed the PlanarMet 300 Planar Grinder enabling shorter preparation times with excellent surface finish and minimal deformation to the material.

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