Cost Effective and Efficient Method for Grinding and Polishing Low- to Very-Hard Carbon Steel Samples For Metallographic Analysis

LECO Corporation; Saint Joseph, Michigan USA

Instrument: GPX (200 or 300) Grinder/Polisher

Equipment

GPX (200 or 300) Automatic Grinder/Polisher with a CAMEO Platinum I Grinding Disc and a 3 micron FeStar Polishing Film.

Preparing Steels

Whether steel samples require metallographic preparation for microstructural assessment or for microhardness testing, accurate results are needed as quickly as possible.

For low- to very-hard carbon steels, a traditional metallographic procedure may involve three grinding steps—using silicon carbide discs—followed by two or three polishing steps and, finally, etching. This entire process might take twelve minutes, including time for cleaning the samples in between polishing steps. Using LECO's CAMEO grinding and pre-polishing system would reduce the overall preparation time, but not by more than a minute or two.

Use of the FeStar Polishing Film—in conjunction with a CAMEO Platinum 1 grinding disc—can significantly shorten the preparation time, with reduced metallographic consumables. Such a system can shorten the grinding/polishing process to three steps, and save the technician at least four minutes per specimen holder. The FeStar polishing system benefits people currently grinding with silicon carbide discs and those already grinding using a CAMEO Platinum 1 disc.

Detailed below are two procedures for metallographically preparing steels in the Rockwell "C" 20 to 65 range. The first is a "typical" procedure involving grinding with a CAMEO Platinum (diamond) disc followed by a "pre-polishing" step and two polishing steps. The second procedure involves one grinding step followed by polishing using LECO's recently introduced FeStar diamond polishing film and final polishing with 0.05 µm Colloidal Silica. Eventually, both sets of samples were etched using a 2% Nital solution.

Sampling and Sample Preparation

Sample Identifications

Case Hardened 8620 Steel

Sectioning

Saw	MSX255M
Blade	10-inch Al_2O_3 (P/N 812-231)
Speed	2865 RPM
Coolant/Rust Inhibitor	P/N 812-469

Mounting

Press	PR4X
Media	Bakelite
Other Comments	P/N 811-111 "Normal Cycle"

Typical Metallographic Preparation Method

Grinding - GPX200 (10" Wheel) - Fixed Sample Holder

	Time (Min:Sec)	Head Direction	Head Pressure (Pounds)	Head Speed (RPM)	Wheel Direction	Wheel Speed (RPM)
Platinum #1 (812-337)/Water	2:00	CW	35	75	CCW	200

Pre-Polishing - FAS Magnetic System/10"/(812-382)

	Time (Min:Sec)	Head Direction	Head Pressure (Pounds)	Head Speed (RPM)	Wheel Direction	Wheel Speed (RPM)
Silver Disk/ 6 µm Cameo Suspension/Microid Extender (812-340/812-356/811-003)	2:00	CW	35	75	CCW	200

Polishing

	Time (Min:Sec)	Head Direction	Head Pressure (Pounds)	Head Speed (RPM)	Wheel Direction	Wheel Speed (RPM)
3 µm Premium Suspension/ Ultra Silk/Microid Extender (810-997-016/812-438/811-003)	3:00	CW	40	100	CCW	200
1 µm Premium Suspension/Red Felt/Microid Extender (810-998-016/812-225/811-003)	0:30	CW	40	100	CCW	200
0.05 µm Colloidal Silica/Imperial Cloth (812-121-300/812-226-010)	0:30	CW	30	100	CCW	200

Etching

	Time (Min:Sec)
2% Nital	Approximately 00:20

Total Preparation Time

Approximately 12 Minutes

Metallographic Application Note

Delivering the Right Results

Improved Metallographic Preparation Method

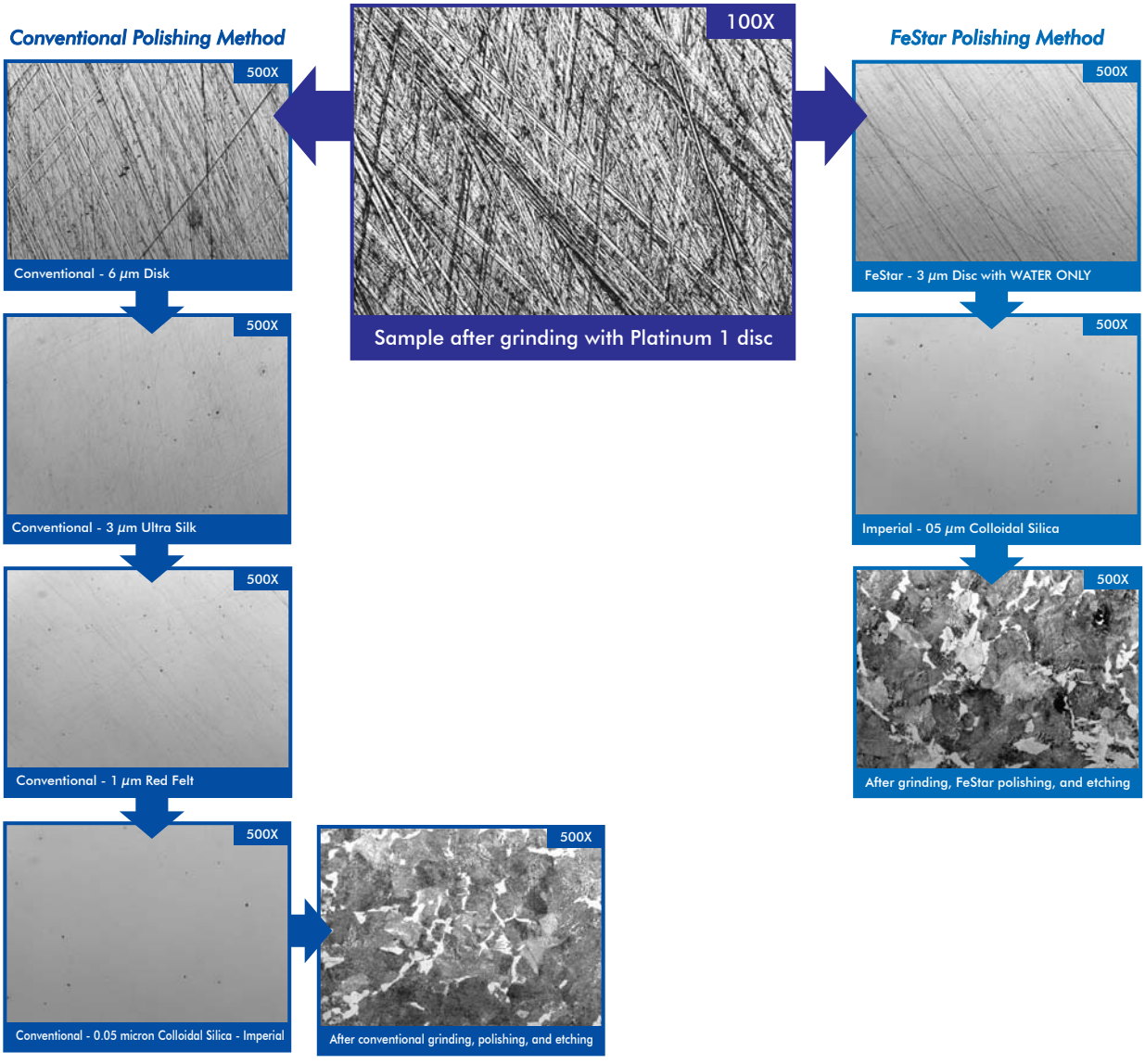
Grinding - GPX200 (10" Wheel) - Fixed Sample Holder						
	Time (Min:Sec)	**Head Direction**	**Head Pressure (Pounds)**	**Head Speed (RPM)**	**Wheel Direction**	**Wheel Speed (RPM)**
Platinum #1 (812-337)/Water	2:00	CW	35	150	CCW	300

Polishing - 3 µm FeStar Diamond Film (P/N 812-491)/Water						
	Time (Min:Sec)	**Head Direction**	**Head Pressure (Pounds)**	**Head Speed (RPM)**	**Wheel Direction**	**Wheel Speed (RPM)**
3 µm FeStar Diamond Film (P/N 812-491)/Water	2:00	CW	35	150	CCW	300
0.05 µm Colloidal Silica/Imperial Cloth (812-121-300/812-226-010)	0:30	CW	30	100	CCW	200

Etching	
	Time (Min:Sec)
2% Nital	Approximately 00:20

Total Preparation Time
Approximately 8 Minutes

Captured Images



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Delivering the Right Results