

Introducing Thermo Scientific Niton Apollo

Apollo LIBS



- Niton Apollo is a handheld LIBS (Laser Induced Breakdown Spectroscopy) analyzer
- Thermo Scientific's first handheld analyzer capable of measuring carbon



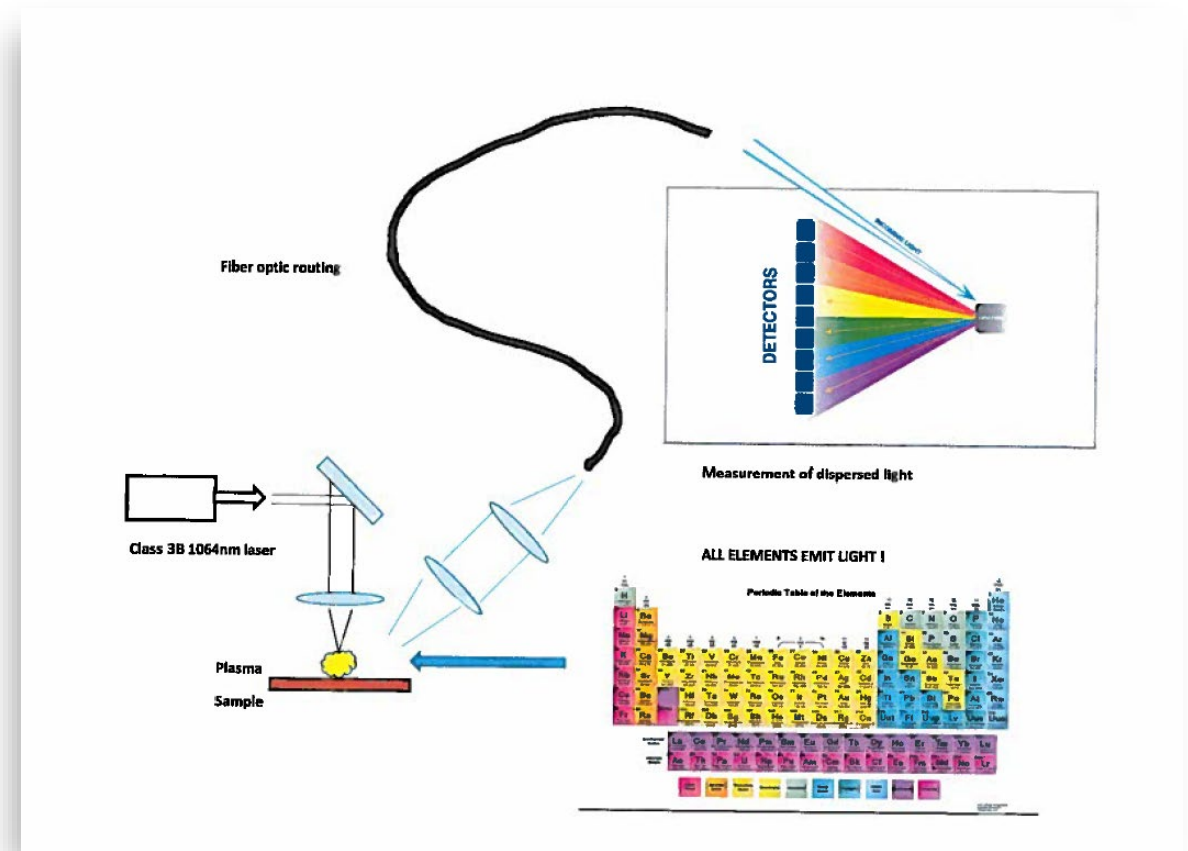
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LIBS: How it works

- Pulsed laser is fired at the sample and vaporizes the material to form a plasma on the surface
- 1 reading ~200 pulses and lasts 11 seconds
- Excited electrons return to ground state in atoms and ions, emitting light which is collected by onboard spectrometers
- Apollo software and calibrations compare the wavelengths and intensity of spectral lines to quantify the concentrations of elements
- Spot size ~0.05mm (50 microns)
- Susceptible to heterogeneous sample effects



Niton Apollo General Performance

- Fast analysis time of 11 seconds
- Capable of quantifying Carbon in low alloy and carbon steels
- Also measures/calculates: Mn, Si, Cr, Mo, V, Cu, Ni, Al, Ti, W, Carbon Equivalency (CE), and other pseudo elements
- Fast analysis for tramp elements: Cu, Cr, etc.
- Ability to quantify and sort carbon steel grades

								18
								2 He 4.0026
			13	14	15	16	17	10 Ne 20.180
			5 B 10.81	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	
			13 Al 26.982	14 Si 28.085	15 P 30.974	16 S 32.06	17 Cl 35.45	18 Ar 39.948
	11	12						
	29 Cu 63.546	30 Zn 65.38	31 Ga 69.723	32 Ge 72.630	33 As 74.922	34 Se 78.97	35 Br 79.904	36 Kr 83.798
	47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29

Reading	Sample	C	Mn	Cu	Si	Ni	Cr	Mo	V	Ti	Al	CE
495	20 api 5l x65	0.0491	1.0612	0.1184	0.2857	0.1173	0.0904	0.0858	0.0805	0.0051	0.0377	0.293
496	20 api 5l x65	0.0424	1.2088	0.1183	0.2793	0.095	0.0866	0.0937	0.0867	0.0046	0.0238	0.3115
497	20 api 5l x65	0.0398	1.1335	0.1147	0.2772	0.1054	0.0907	0.0914	0.0846	0.0048	0.0301	0.2967
498	20 api 5l x65	0.0417	1.1158	0.1182	0.2836	0.1124	0.0957	0.0952	0.0765	0.0045	0.0306	0.2965
499	20 api 5l x65	0.0392	1.1955	0.1161	0.2762	0.0941	0.0798	0.0984	0.0876	0.0052	0.0284	0.3056
501	20 api 5l x65	0.0341	1.1706	0.1133	0.2796	0.1023	0.0916	0.1084	0.0834	0.0045	0.0296	0.3003
502	20 api 5l x65	0.0392	1.0909	0.1238	0.2891	0.106	0.0899	0.0786	0.0747	0.0058	0.0315	0.3204
503	20 api 5l x65	0.0532	1.1271	0.1157	0.2727	0.1085	0.0874	0.0933	0.0807	0.005	0.0342	0.3083
504	20 api 5l x65	0.0414	1.0775	0.1173	0.3101	0.1069	0.0951	0.0679	0.0745	0.0044	0.0382	0.3299
505	20 api 5l x65	0.0301	1.115	0.11	0.2745	0.0981	0.0885	0.0999	0.0787	0.0045	0.0335	0.2832
AVG		0.0410	1.1296	0.1166	0.2828	0.1046	0.0896	0.0913	0.0808	0.0048	0.0318	0.3045
STDEV		0.0066	0.0490	0.0037	0.0109	0.0074	0.0045	0.0115	0.0047	0.0004	0.0043	0.0137
RSD		16%	4%	3%	4%	7%	5%	13%	6%	9%	14%	5%

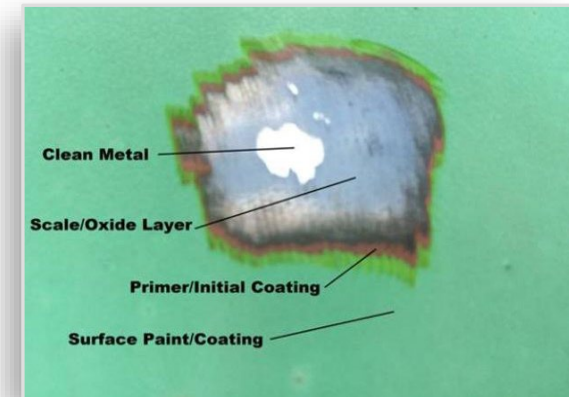
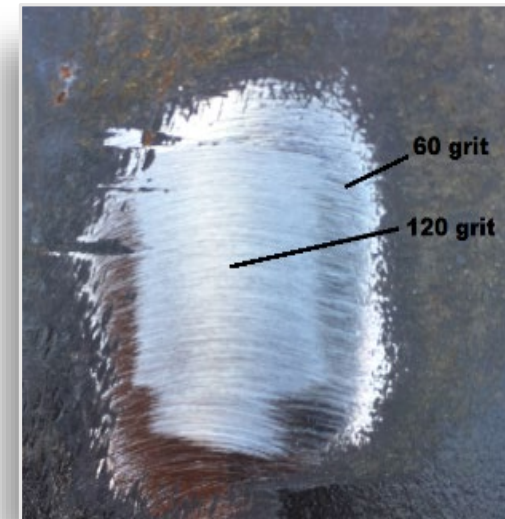
Apollo Accuracy

Sample: BS 70B 41L40

Inst	C	Mn	Cr	Ni	Mo	Cu	Al	Si	CE
1	.415	1.02	1.09	.270	.216	.122	.021	.251	.873
2	.363	.908	1.06	.261	.240	.131	.021	.254	.803
3	.413	.888	1.08	.248	.198	.125	.018	.275	.845
4	.442	.852	1.15	.253	.203	.121	.016	.275	.882
5	.420	.951	.91	.239	.243	.118	.020	.271	.833
6	.390	.965	1.08	.252	.226	.140	.026	.294	.841
7	.429	.950	1.05	.238	.210	.126	.013	.258	.865
8	.344	.988	1.01	.210	.246	.124	.017	.266	.783
9	.405	.935	1.06	.260	.205	.131	.020	.274	.839
10	.417	.975	1.06	.229	.251	.114	.021	.269	.867
11	.417	.916	1.04	.262	.221	.122	.017	.265	.848
12	.400	.862	1.03	.245	.212	.124	.021	.262	.813
Average	.404	.934	1.05	.247	.223	.125	.019	.268	.841
Certified	0.40	.90	1.00	.25	.205	.13	.024	.27	.816
Avg Rec %	101.1	103.8	105.2	98.9	108.7	96.2	80.2	99.3	103.1

LIBS: Prepare for Your Testing, Always Grind!

- Use factory specified Zr-Al oxide grinding media (60 - 80 grit for LA/c-steel)
- Make sure sample is free of any oils from cutting, quenching, etc. to avoid carbon contamination
- Always grind sample carefully before testing. It may be necessary to use a heavy-duty wheel grinder to get below a de-carb layer, and use Zr-Al oxide media for final prep
- Change disk if it becomes contaminated with dirt, oil, scale, paint, etc.
- Grind sample to clean, bright, representative surface with approximately ½-1" diameter area ground clean. *Do not touch ground area prior to testing!*



Laser Safety

- Class 3B laser ~ 11-meter hazard radius
- Three (3) robust safety interlocks:
 - Pressure
 - Camera (Light/Dark)
 - Spectral
- Safety interlocks are validated by a 3rd party lab
- Thermo Fisher Scientific Laser Safety Training support provided for customers



Niton Apollo Specifications and Features

Hardware:

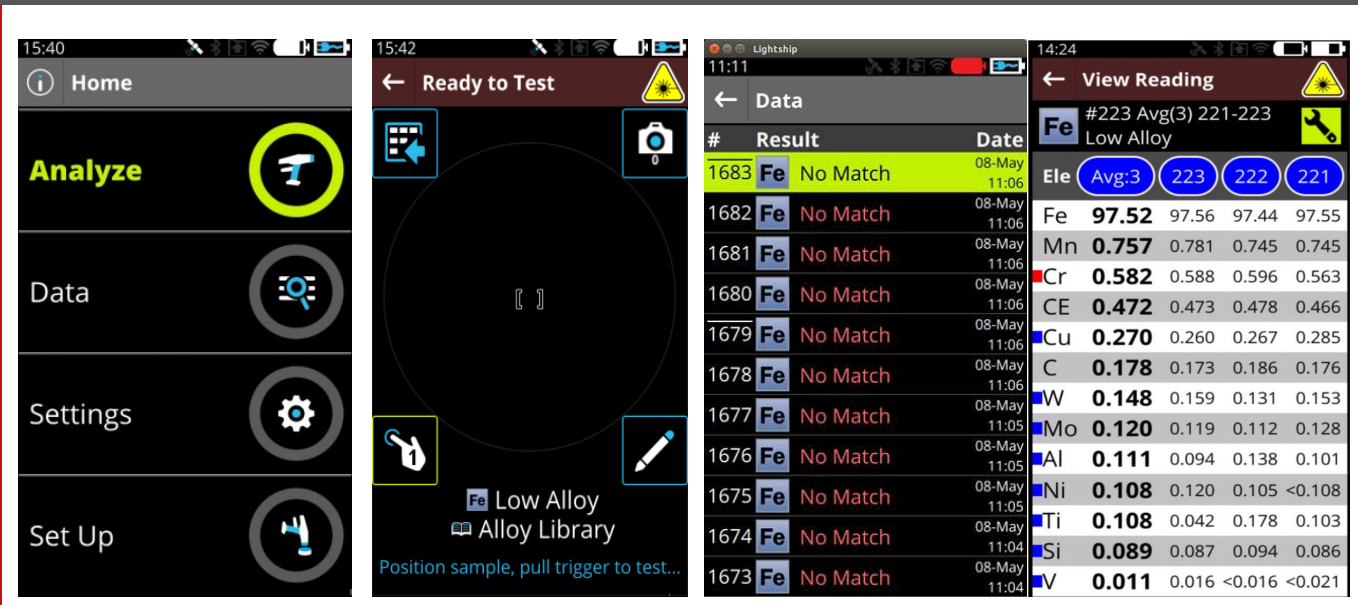
- Similar form factor design and User Interface (UI) to XL5
- NitonConnect reporting software with free new version upgrades for life of the analyzer
- Weighs ~ 6 lbs
- Hinged Screen Design
- Hot Swappable, off-the-shelf Milwaukee M18 battery & charger
- Battery Life 3-5 hours
- Features micro- and macro-cameras for sample positioning and data documentation



Niton Apollo Specifications and Features

User Interface:

- Large touchscreen for easy operation
- Consistent on device user interface with XL5 series
- Same keypad layout as XL5 for scrolling
- Displays data as single readings or in averaging mode
- Type Standardization feature



Niton Apollo Stormcase & Accessories

- (1) Apollo LIBS analyzer
- (2) Milwaukee M18 Li batteries
- (5) argon cylinders shipped separately
- Clear plastic box for spare nose seals, carabiner, and other misc. accessories
- Containers with Wave & Sensitivity check samples
- Pocket on lid of case contains Quick Start Guide, USB cable, check sample certificates, etc.
- Additional items: battery charger, AC power pack, cleaning kit, bulk Ar connector



Niton Apollo Key Benefits

- **Increased Efficiency:**

- Higher production rate
- Analysis time of just 11 seconds
- Short set-up time

- **Expanded Field Use:**

- Compact design weighing only 6 lbs
- Can easily bring the analyzer to the yard, shop floor, laboratory or loading dock
- Mitigate safety risks of trying to use current OES technology in dangerous environments

- **Robust Safety Features:**

- Three (3) redundant safety interlocks validated by a 3rd party
- Laser safety training and resources provided

- **Functionality:**

- Familiar user interface for current XL5 XRF users
- Intuitive design
- Large, hinged touch screen that can be used with a gloved hand

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