



Southwest Spectro-Chem Labs

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**OVERALL WEAR
JUDGEMENT**

4-Critical

Analytical Ferrograph Report

SAMPLE INFORMATION			
CUSTOMER #:	123456	LAB SAMPLE #:	Z0001
CUSTOMER:	SWSC LABS	OIL USED:	MOBIL DTE EXTRA HEAVY
LOCATION:	SOUTH HOUSTON, TX	TIME ON OIL:	N/A
UNIT:	C-001B	SAMPLE DATE:	08/05/15
DESCRIPTION:	HYDROGEN COMPRESSOR	REPORT DATE:	08/31/15
SERIAL #:	7139443694	ANALYST:	TC
EQUIP NO:	1009		

PARTICLE ANALYSIS

1 - Normal; 2 - Watch; 3 - Alert; 4 - Critical

FERROUS METAL WEAR	SEVERITY
RUBBING	4
SEVERE WEAR	2
CUTTING	
LAMINAR PARTICLES	
SPHERES	
CHUNKS	3
RED OXIDES	2
DARK OXIDES	4
ADHESION WEAR	
ABRASION WEAR	
SLIDING	
COPPER/COPPER ALLOY WEAR	SEVERITY
RUBBING	
SEVERE WEAR	
CUTTING	
LAMINAR PARTICLES	
SPHERES	
FATIGUE CHUNKS	
ABRASION WEAR	
SLIDING	
OTHER NON-MAGNETIC PARTICLES	SEVERITY
INORGANIC/BIREFRINGENT	
WHITE METAL	
MOLYBDENUM DISULFIDE	
OTHER NON-METALLIC PARTICLES	SEVERITY
ORGANIC/BIREFRINGENT	
SILICEOUS	2
FRICTION POLYMER	
FIBERS	2
LACQUER	
AMORPHOUS	
CARBONACEOUS	

METAL CONTENT, ppm by Emission Spectroscopy

NOTE: Particles greater than 10-microns will probably not be measured in the emission spectrometer.

WEAR			
Iron	320	Tin	39
Copper	41	Nickel	5
Aluminum	54	Titanium	0
Chromium	2	Silver	0
Lead	56	Vanadium	0
ADDITIVE			
Magnesium	15		
Calcium	157		
Barium	6		
Phosphorous	1250		
Zinc	1959		
MULTI-SOURCE			
Molybdenum	4		
Antimony	0		
Boron	2		
CONTAMINANT			
Silicon	95		
Sodium	55		
Potassium	54		
PHYSICAL PROPERTIES			
Ferro D.R, Small	3.2		
Ferro D.R, Large	4.1		
KF Water	11	ppm	
TAN	0.00	mg/g	

SAMPLE #:Z0001

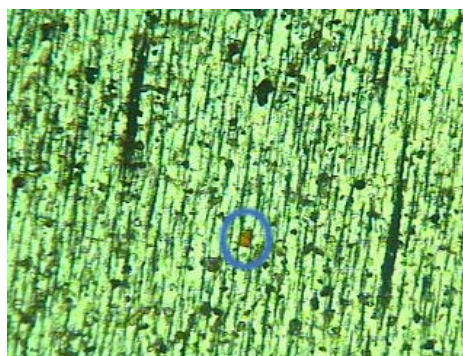
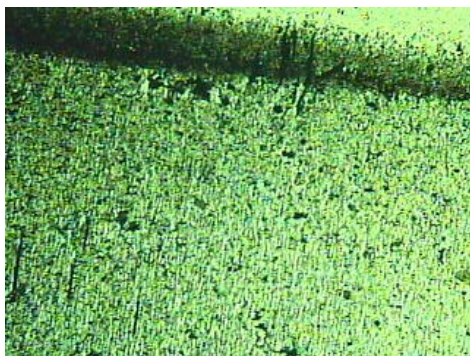


PHOTO-MICROGRAPH A @ 100 X
This image shows the high concentration of wears and contaminants trapped in the filter as the slide entrance is full of submicron particles even when the extracted oil is already diluted 1:100 with a solvent.

PHOTO-MICROGRAPH B @ 400 X
Numerous amounts of ferrous rubbing wear are aligned in the magnetic field. Some of these ferrous wears have oxidized under high heat stress into black oxides. A red oxide is also noticeable here.

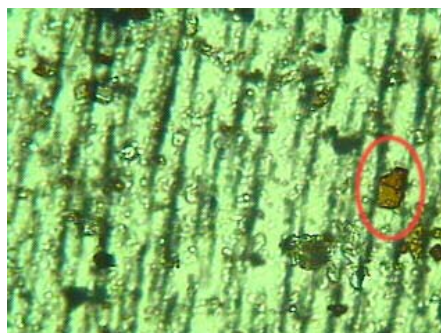
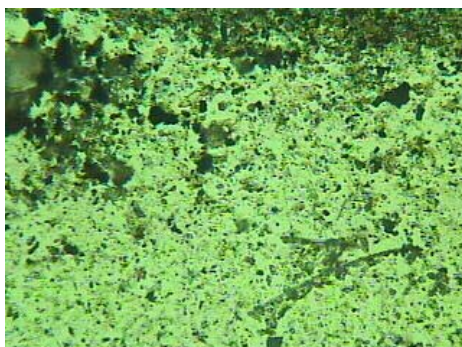


PHOTO-MICROGRAPH C @ 400 X
Some other submicron black oxide chunks and filter fibers are visible on the ferrography slide.

PHOTO-MICROGRAPH D @ 1000 X
A close look at a small red oxide gear wear.

SUMMARY:

This sample is prepared in the same manner for a ferrography analysis. The ferrography slide contains a high concentration of various wear particles such as rubbing wear, black oxide, red oxides and siliceous debris. Red oxides appear more frequently in this ferrography slide than other samples analyzed in the same batch as the water content is much higher in this sample. With its current particle density and type, the sample wear condition is CRITICAL.

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