

# 1.000 Bearings Failed – Who is to Blame?

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**LUBRICANT EXPO  
THE BEARING SHOW**

**Düsseldorf 17 - 19th September 2024**

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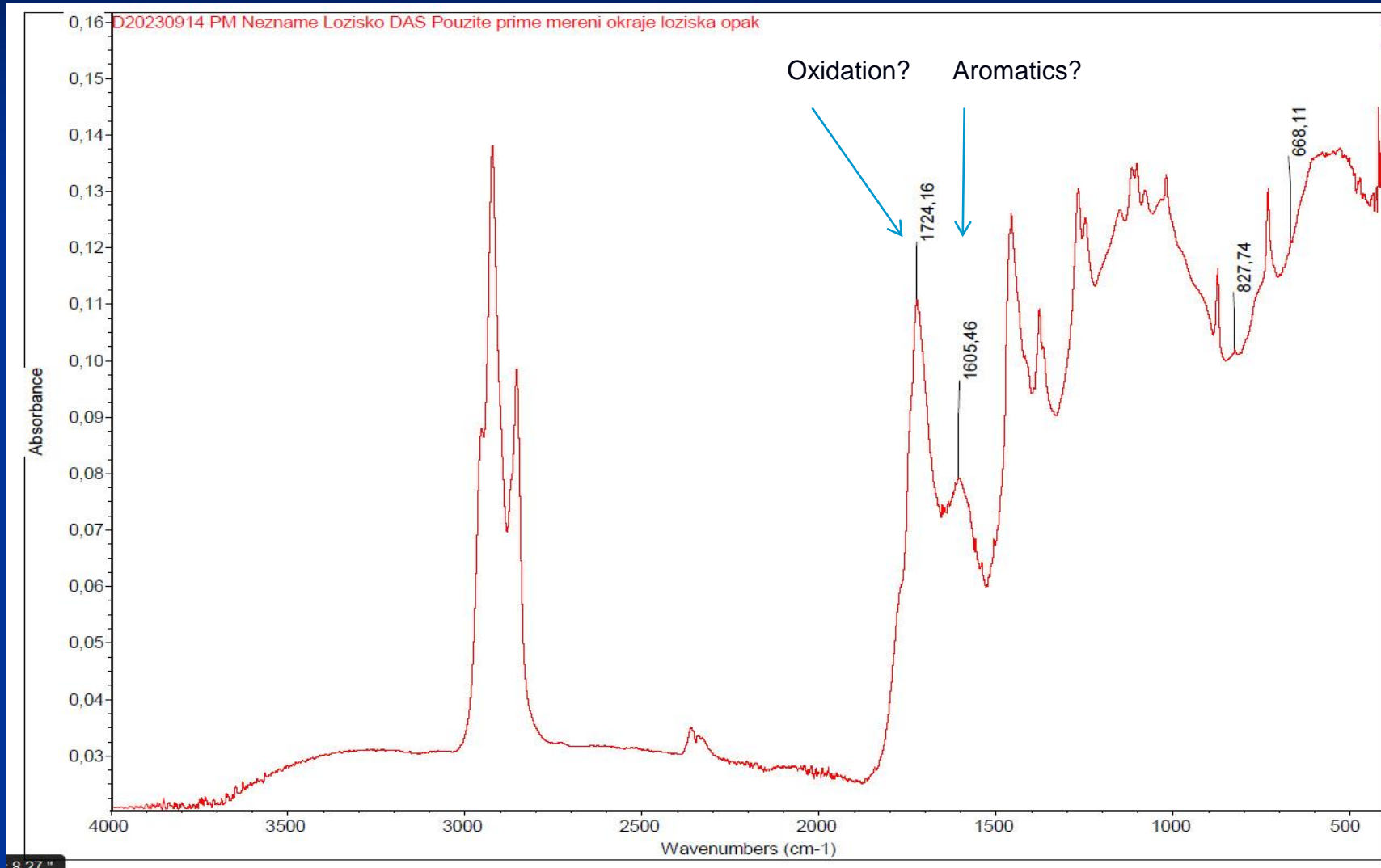


## ? Grease in Bearings?



- The laboratory of LUBRICANT s.r.o. got an order to analyze, what caused bearing failure.
- Both bearings were stucked.



# FTIR ATR Analysis of Disassembled Bearing



# OES-ICP Analysis of Hydrocarbon Solvent after Flushing of Bearings

 <p><b>UIN 0A329D0</b></p>		<b>DATUM ODBĚRU VZORKU</b> 12-Sep-23 <b>DATUM PŘJETÍ VZORKU</b> 20-Sep-23 <b>DATUM VYDÁNÍ PROTOKOLU</b> 20-Sep-23	
		LABORATORNÍ Č. 60007358331 SIF Č. 702691517	
<b>lozisko</b> <b>Zařízení č.</b> Nezname lozisko DAS <b>Zařízení</b> <b>Výrobce</b> <b>Model</b> <b>Sériové č.</b> <b>Umístění</b> <b>Díl</b> <b>Název</b> použite otevrene mazivo <b>Výrobce</b> <b>Model</b> <b>Sériové č.</b> <b>Kapacita</b> Ltrs		NÁZEV OLEJE Unidentified VSKOZITNÍ TŘÍDA OLEJE Kapitalina DOPLNĚNÍ OLEJE - DOBA PROVOZU FILTRU Ltrs VÝMĚNA OLEJE Hrs ZAKÁZKA Č.	
<b>ZÁKAZNÍK</b> LUBRICANT S.R.O. Slovanská alej 24 326 00 Plzen Česká Republika		<b>Kovy (ppm)</b> stříbro <1 hliník (Al) <1 bismut (Bi) <1 kadmium (Cd) <1 chrom (Cr) <1 měď (Cu) <1 železo (Fe) 1 mangan (Mn) <1 nikl (Ni) <1 olovo (Pb) <1 antimon (Sb) <1 cín (Sn) <1 titan (Ti) <1 vanad (V) <1	
<b>DIAGNOSTIKA</b> Hodnocení se nevztahuje na naměřené parametry.		<b>kontaminace/aditiva (ppm)</b> bor (B) <5 baryum (Ba) <1 vápník (Ca) 5 draslík (K) <1 horčík (Mg) <1 molybden (Mo) <1 fosfor (P) 2 zinek (Zn) 1 lithium (Li) <1 sodík (Na) <1 kremík (Si) <1 síra (S) 18	

 <p><b>UIN 0A329D1</b></p>		<b>DATUM ODBĚRU VZORKU</b> 12-Sep-23 <b>DATUM PŘJETÍ VZORKU</b> 20-Sep-23 <b>DATUM VYDÁNÍ PROTOKOLU</b> 20-Sep-23	
		LABORATORNÍ Č. 60007358332 SIF Č. 702691518	
<b>lozisko</b> <b>Zařízení č.</b> Nezname lozisko DAS <b>Zařízení</b> <b>Výrobce</b> <b>Model</b> <b>Sériové č.</b> <b>Umístění</b> <b>Díl</b> <b>Název</b> nove mazivo <b>Výrobce</b> <b>Model</b> <b>Sériové č.</b> <b>Kapacita</b> 0.0 Ltrs		NÁZEV OLEJE Unidentified VSKOZITNÍ TŘÍDA OLEJE Kapitalina DOPLNĚNÍ OLEJE - DOBA PROVOZU FILTRU Ltrs VÝMĚNA OLEJE Hrs ZAKÁZKA Č.	
<b>ZÁKAZNÍK</b> LUBRICANT S.R.O. Slovanská alej 24 326 00 Plzen Česká Republika		<b>Kovy (ppm)</b> stříbro <1 hliník (Al) <1 bismut (Bi) <1 kadmium (Cd) <1 chrom (Cr) <1 měď (Cu) <1 železo (Fe) 2 mangan (Mn) 1 nikl (Ni) <1 olovo (Pb) <1 antimon (Sb) <1 cín (Sn) <1 titan (Ti) <1 vanad (V) <1	
<b>DIAGNOSTIKA</b> Hodnocení se nevztahuje na naměřené parametry.		<b>kontaminace/aditiva (ppm)</b> bor (B) <5 baryum (Ba) <1 vápník (Ca) 43 draslík (K) <1 horčík (Mg) <1 molybden (Mo) <1 fosfor (P) 1 zinek (Zn) <1 lithium (Li) <1 sodík (Na) <1 kremík (Si) 3 síra (S) <10	

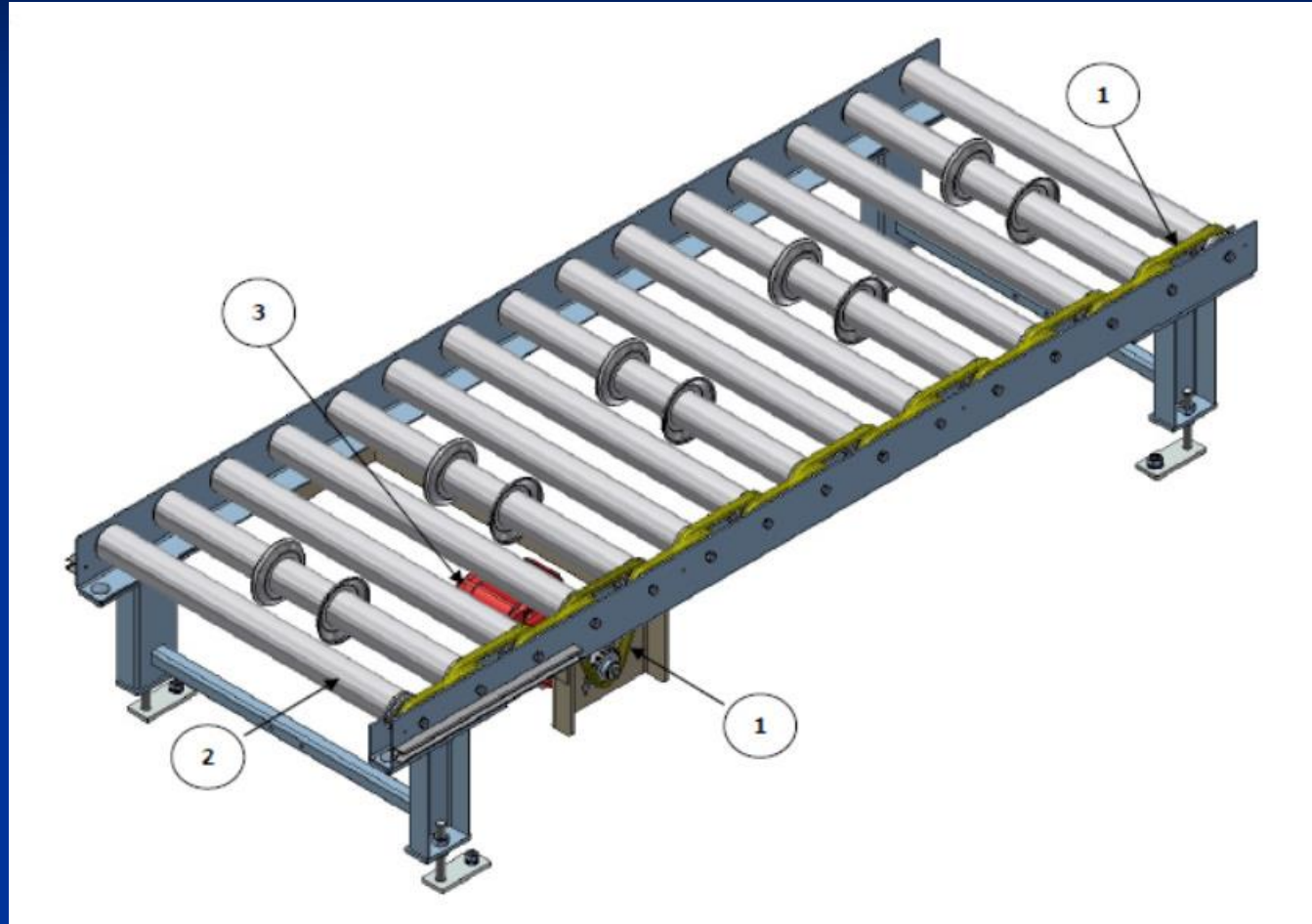
# Visual Inspection, FTIR ATR and OES-ICP Preliminary Results

- No grease residue was found in the first bearing.
- Small volume of deposits from the second bearing was analyzed by FTIR ATR – only oxidation products ( $1724\text{ cm}^{-1}$ ) and aromatics ( $1605\text{ cm}^{-1}$ ) were evaluated.
- No metal thickener was identified by OES-ICP, low Ca concentration shows on traces of corrosion preventive, based on calcium sulphonate in the second bearing.

# Another Bearings after 3 Month of Operation at 160°C



# Drying Oven for Plastisol Application



Temperature = 160°C

Oven length = 31 meters

Time of appl. = 40 minutes

Bearing 6202ZZ for 200°C  
inside of 500 rollers

Hundreds chains

4 transmission gears

Everything was placed inside  
of the oven, in hot area

# Stucked Bearings after 3 Month of Operation

Bearings  
6202 ZZ  
ENC200°C

Vizuální kontrola ložisek 6202ZZ ENC200°C SPAIN, kontaminovaná strana – ulpívající fragmenty degradovaného plastického maziva





# Stucked Bearings after 3 Month of Operation

Vizuální kontrola ložisek 6202ZZ ENC200°C SPAIN - vnitřní prostor ložiska znečištěný degradovaným plastickým mazivem



Vizuální kontrola ložisek 6202ZZ ENC200°C SPAIN - vnitřní prostor ložiska znečištěný degradovaným plastickým mazivem

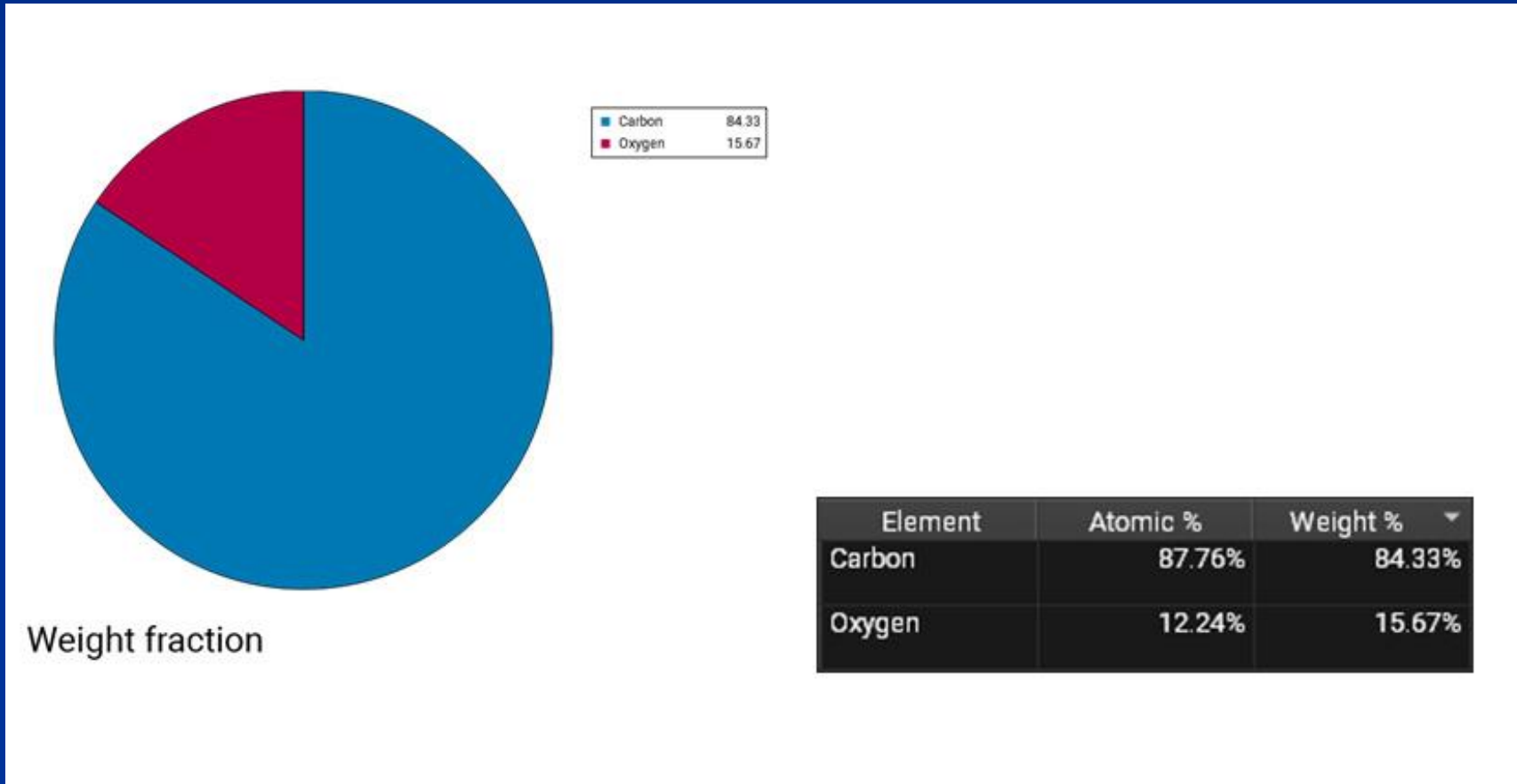


# Stucked Chain after 3 Month of Operation

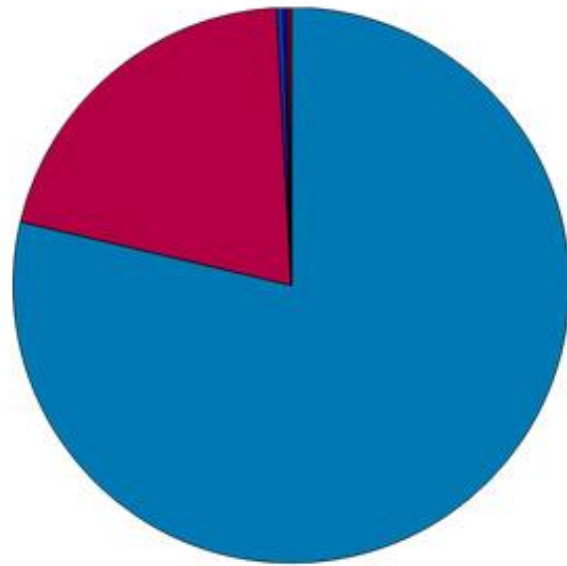
Příloha 8 – Fotodokumentace řetězu pohánějící dopravník



# Deposits Analysis by Scanning Electron Microscope



# Deposits Analysis by Scanning Electron Microscope



Carbon	78.66
Oxygen	20.50
Sodium	0.37
Iron	0.25
Calcium	0.22

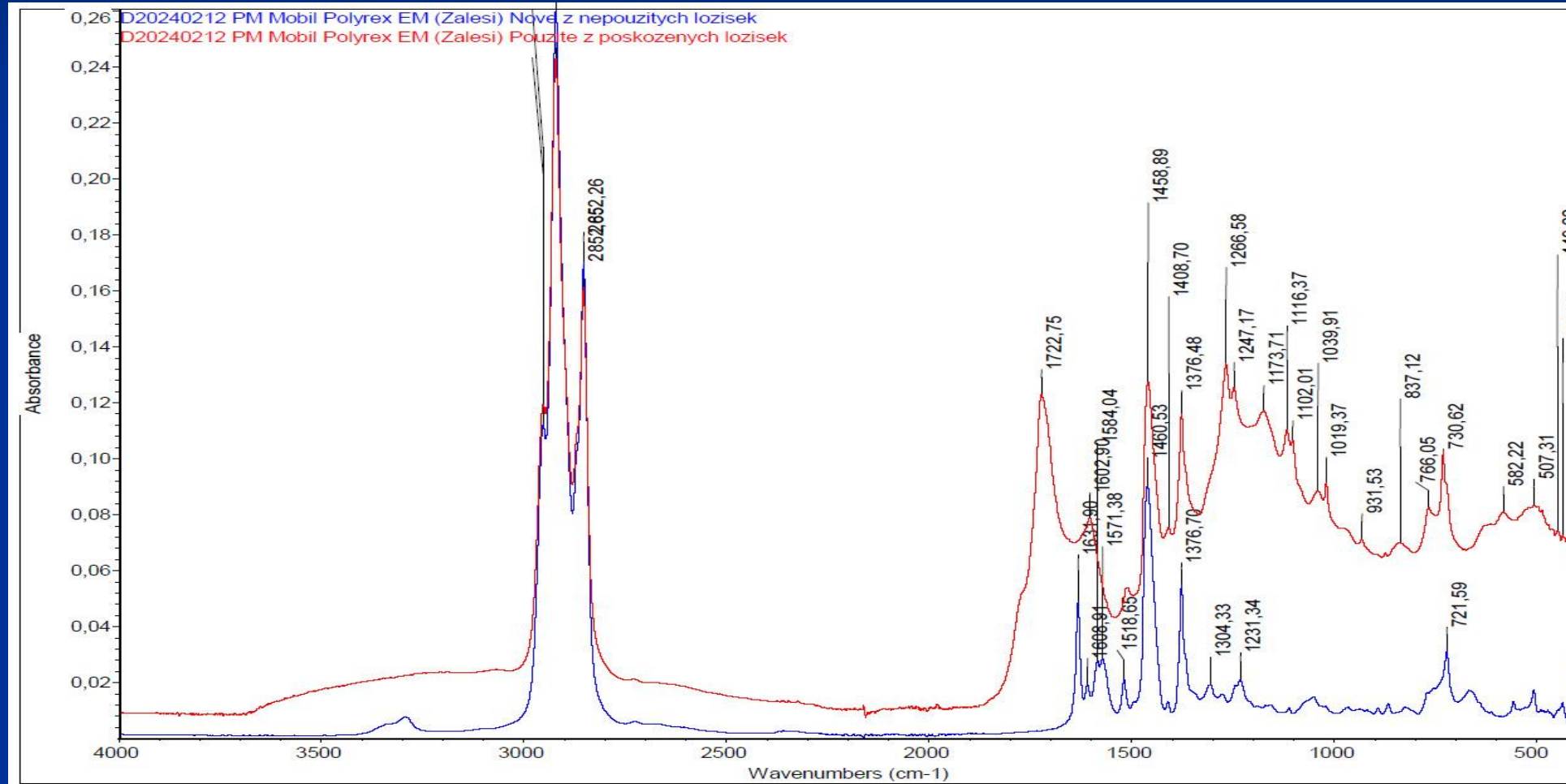
Weight fraction

Element	Atomic %	Weight %
Carbon	83.36%	78.66%
Oxygen	16.31%	20.5%
Sodium	0.2%	0.37%
Iron	0.06%	0.25%
Calcium	0.07%	0.22%

# Elemental Analysis of Deposits

Element	Mobil Polyrex EM, % wt.	Deposits, % wt.
C	84,69	77,02
H	13,33	10,08
N	0,95	1,25
S	0,16	0,43
Cl	0,01	0,39

# FTIR ATR Analysis of Fresh PU Grease and Deposits



--- Deposits  
--- Fresh PU grease

# Mobil Polyrex EM – Designer Recommendation

- Premium grease based on polyurea and mineral oil with KV40°C = 115 mm<sup>2</sup>/s. NLGI 2.
- Dropping point 260°C
- Very good oil separation
- Lubrication life @177°C > 750 h.

# Mobil Polyrex EM – Designer Recommendation

Super-premium Mobil Polyrex™ EM Series greases are specially formulated for electric motor bearings. The advanced thickener formulation and proprietary manufacturing techniques provide improved bearing performance and protection for long electric motor life.

## Features and Benefits

Mobil Polyrex EM and Mobil Polyrex EM 103 offer the following features and benefits:

Features	Advantages and Potential Benefits
Outstanding grease life	Outstanding long-life, high-temperature lubrication of ball and roller bearings, particularly in sealed-for-life applications
Advanced polyurea thickener	Increased durability versus conventional polyurea greases when subjected to mechanical shear forces
Excellent corrosion resistance	Mobil Polyrex EM and Mobil Polyrex EM 103 provide protection against rust and corrosion. Mobil Polyrex EM provides additional protection under mild salt-water wash conditions versus Polyrex EM 103
Low-noise properties	Mobil Polyrex EM is suitable for lubrication of ball bearings in many noise-sensitive applications

## Applications

Mobil Polyrex EM greases are recommended by many major bearing and electric motor manufacturers for long-life lubrication of electric motor ball and roller bearings.

Mobil Polyrex EM 103 is more specifically recommended for applications such as vertically mounted bearings, or very large motors where a stiffer grease consistency may be required by the OEM.

Mobil Polyrex EM greases have been shown to be compatible with a number of ExxonMobil lithium complex greases, as well as competitive electric motor mineral polyurea products, as determined by the methodology of ASTM D6185. For specific questions about grease compatibility, contact your Mobil representative.

Property	MOBIL POLYREX EM
Grade	NLGI 2
Thickener Type	Polyurea
Color, Visual	Blue
Copper Strip Corrosion, 24 h, 100 C, Rating, ASTM D4048	1A
Corrosion Preventive Properties, Rating, ASTM D1743	Pass
Dropping Point, °C, ASTM D2265	260
Four-Ball Wear Test, Scar Diameter, mm, ASTM D2266	0,41
Low Temperature Torque, Running, -29 C, g-cm, ASTM D1478	405
Low Temperature Torque, Starting, -29 C, g-cm, ASTM D1478	3630
Lubrication Life @ 177 C, h, ASTM D3336	750+
Oil Separation, 0,25 psi, 24 h @ 25 C, mass%, ASTM D1742	0,5
Penetration, 60X, 0,1 mm, ASTM D217	285
Penetration, Change from 60X to 100,000X, 0,1 mm, ASTM D217	40
SKF Emcor Rust Test, 10% Synthetic Sea Water, ASTM D6138	0, 1
Viscosity @ 100 C, Base Oil, mm <sup>2</sup> /s, ASTM D445	12,2
Viscosity @ 40 C, Base Oil, mm <sup>2</sup> /s, ASTM D445	115
Viscosity Index, ASTM D2270	95
Water Washout, Loss @ 79 C, wt%, ASTM D1264	1,9



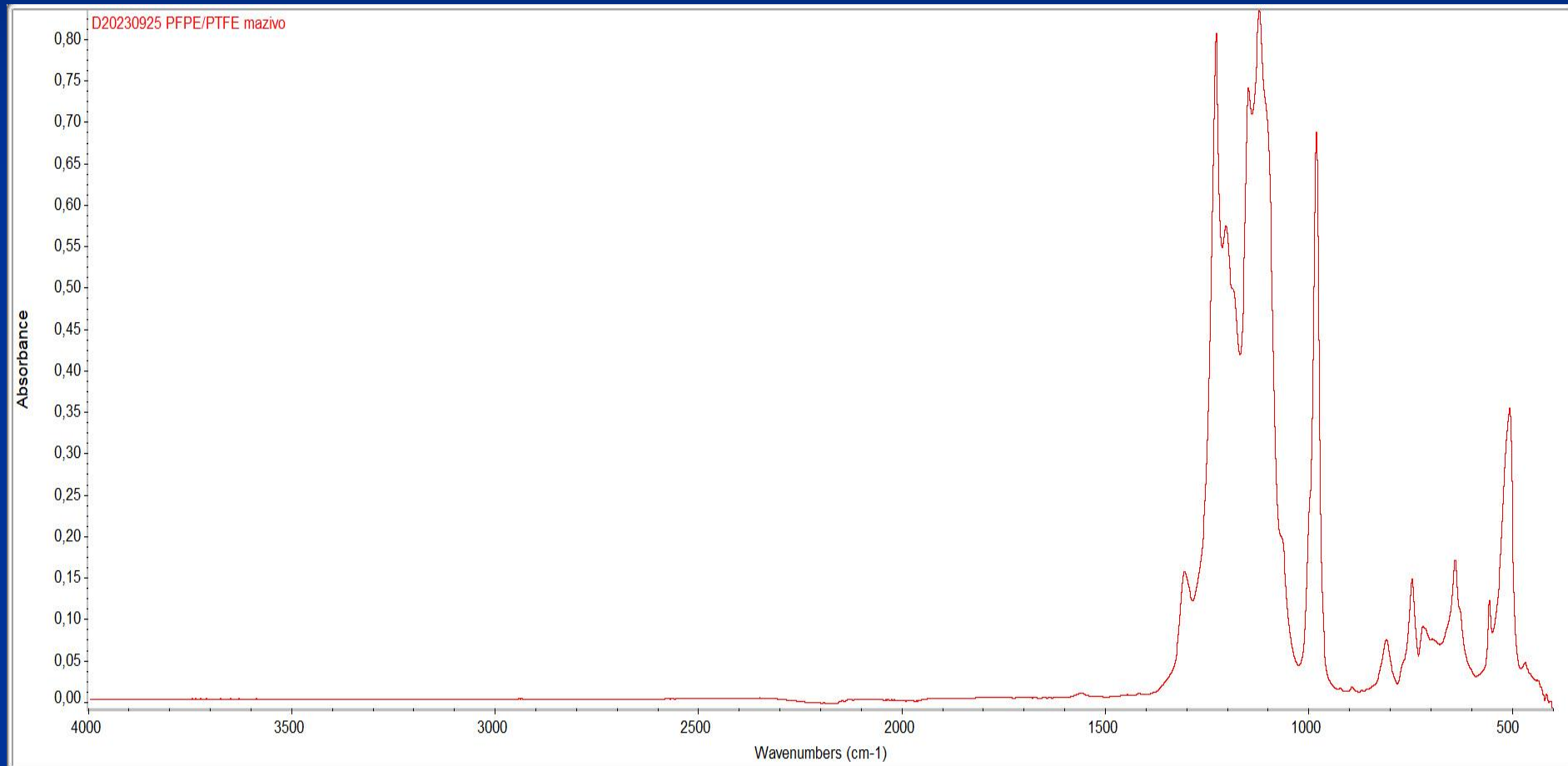
# Grease Temperature Resistance

**Short term** temperature resistance (only examples with mineral oil):

- Li thickener 140°C
- Li complex thickener 160°C
- Polyurea thickener 180°C
- Inorganic thick. (bentonite, gel) 200°C
- -----
- PFPE/PTFE 280°C



# FTIR ATR of New Fluorinated Grease

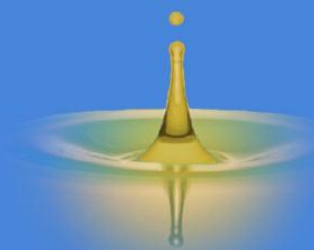


# Discussion

- Too many suppliers, subcontractors and designers with poor communication among them.
- Bearings were ordered from different suppliers, nobody checked grease filling.
- All lubricating points were placed inside of drying oven, where the permanent temperature  $160^{\circ}\text{C}$  was too high for common lubricants.
- 1000 double sided bearings had not any possibility for relubrication.
- Chlorine traces were found in deposits, maybe from Plastisol decomposition. Chlorine causes corrosion and shortens the lifetime of lubricant.

# Summary

- Wrong design of drying oven – lubricating contacts should be outside of drying oven
- All lubricating places should be designed with the possibility of relubrication
- Polyurea grease could work properly, if is there a possibility of relubrication
- -----
- 1000 new bearings with higher corrosion resistance were assembled. Extremely expensive fluorinated lubricants were filled in. It works properly for 1 year now.



# Thank for your attention

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