COT bv
Independent advice, research and management for construction and industry

Civil projects
Corrosionprotection
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REPORT

Testing of the system
MCU-MIOZINC / MCU-MIOMASTIC / MCU-MIOTOPCOAT
according to various tests of Shell DEP 70.48.11.30, code FC1-N/M
Atmospheric zone -35 °C up to + 120 °C; New and Maintenance

Haarlem, February 8th, 2013

Client : MCU-Coatings Group

Project number: : 20110685

Report number : LAB13-0071-REP

Handled by : Mr. N. Blokker

CONTENTS

1 INTRODUCTION

1.1 Order

By order of MCU-Coatings Group in Bladel, The Netherlands, the Centrum voor Onderzoek en Technisch advies (COT bv) in Haarlem, The Netherlands, has tested the system MCU-Miozinc / MCU-Miomastic / MCU-Miotopcoat according to various tests of Shell DEP 70.48.11.30, code FC1-N/M Atmospheric zone -35 °C up to + 120 °C; New and Maintenance.

The test program has been offered in the COT e-mail quotation dated March 26th 2012.

1.2 Samples

Table 1: Paint products

Product name	COT sample number	Batch number	Colour	Received
MCU-Miozinc 8520	22-03-12/0225	2909111-SL	Grey	22-03-2012
MCU-Miomastic 8544	22-03-12/0224	1101121-SL	Beige	
MCU-Miotopcoat 8795	22-03-12/0228	1912112-SL	Final green	
MCU-Solvent 7283	22-03-12/0229	202121	-	

2 PROCEDURE

The system has been applied at, and by COT by airless application on grit blasted steel panels (Sa3, Ra 11 ± 2; size 75 x 150 x 5 mm).

All layers have been applied at 20 ± 4 °C and 40 ± 5 % relative humidity between 11 and 14 June 2012.

Table 2: Application data

System	Required dft (µm)	Volume solids (%)	Wet film thickness wft (µm)	Thinner (%)	Pressure (bar)	Nozzle size
1st coat MCU-Miozinc	100	72	140	-	150	0.019"
2nd coat MCU-Miomastic	125	76	165	-	150	0.019"
3rd coat MCU-Miotopcoat	75	62	120	-	150	0.019"

The following tests have been performed:

Table 3: Tests

Test	Method
Application	ISO 20340
Fingerprint	ISO 20340
Ageing resistance	ISO 20340, 4200 hrs
Seawater immersion	ISO 20340 (ISO 2812-2), 4200 hrs
Impact (deformation) resistance	ISO 6272-1
Overcoatability and drying	Shell DEP 2.2.11.5
Adhesion	ISO 4624 (pull-off test)

The tests have been performed in triplicate; the average value (avg) and the standard deviation (std) have been reported.

At the end of the tests, photographs have been taken of the exposed panels (see Annex I).

The tests have been performed in the period between July 2012 and January 2013.

3 RESULTS

Shell Code: FC1-N/M
Atmospheric zone -35 °C up to + 120 °C; New and Maintenance.

3.1 Application

All 3 paints of the system do not exhibit any hard skin, grains or sediment in its original packaging. The paints are easy to stir.
Each paint used in the paint system does not show any sign of running or sagging when applied at a dry film thickness equal to 1.5 times the specified DFT to a smooth, degreased vertical steel plate with an area of 1 m^2.

3.2 Fingerprint

Table 4: Fingerprint data (COT sample number 22-03-12/0225, 22-03-12/0224, 22-03-12/0228)

Item	**Paint product**		
	MCU-Miozinc	**MCU-Miomastic**	**MCU-Miotopcoat**
Infrared spectrum	Polyurethane	Polyurethane	Polyurethane
Non-volatile matter (% by mass)	87 ± 2	82 ± 2	78 ± 2
Density (kg/dm^3)	2.45 ± 0.05	1.66 ± 0.05	1.56 ± 0.05
Ash content (% by mass)	73 ± 3	56 ± 3	52 ±3

The infrared spectra are presented in Annex II.

3.3 Performance tests

Table 5. Performance tests (COT sample number 22-03-12/0225, 22-03-12/0224, 22-03-12/0228)

Coating test	Panel number	Dry film thickness* (µm)	Results	Adhesion ISO 4624 (MPa)	Requirement	Test date
Ageing test ISO 20340	2	311 ± 18	2.9 mm corrosion	12.7 ± 0.4	Corrosion at scribe <7 mm, No blisters, rusting, flaking, cracking (ISO 4628). Adhesion >5 MPa (ISO 4624)	July 2012 till January 2013
	3	335 ± 22	3.3 mm corrosion	12.9 ± 0.1		
	4	326 ± 15	2.9 mm corrosion	12.3 ± 0.1		
Seawater immersion ISO 20340 (ISO 2812-2)	6	358 ± 26	0.0 mm corrosion	Is not determined		July 2012 till January 2013
	9	338 ± 18	0.0 mm corrosion			
	12	325 ± 9	0.0 mm corrosion			
Impact Resistance ISO 6272-1	5	385 ± 24	5x passed	--	2 J	December 2012
	7	391 ± 22	5x passed	--		
	8	354 ± 28	5x passed	--		
Overcoatability Shell 2.2.11.5	2	311 ± 18	Good	12.9 ± 0.1	Topcoat shall be overcoatable for a minimum of 6 months after application	January 2013
	3	335 ± 22	Good	12.4 ± 0.9		
	4	326 ± 15	Good	13.5 ± 0.7		
Touch dry time of the primer Shell 2.2.11.5	--	--	< 2 hours	--	Maximum 2 hours	January 2013
Initial Adhesion ISO 4624	13	364 ± 24	--	12.2 ± 2.0	> 7 MPa	August 2012
	14	364 ± 20	--	12.3 ± 0.9		
	15	360 ± 27	--	11.6 ± 2.0		
Total layer thickness	Avg. all panels	351 ± 24	--	--	--	July 2012
Colour			Final green			

*) Determined by COT according to ISO 2178

4 SUMMARY OF TEST RESULTS

Shell Code: FC1-N/M
Atmospheric zone -35 °C up to + 120 °C; New and Maintenance.

Table 6. Summary of test results (COT sample number 22-03-12/0225, 22-03-12/0224, 22-03-12/0228)

Test	Requirement	Measured average	Pass/Fail
Application	No hard skin, grains or sediment, easy to stir. No running or sagging at 1.5 dft	No hard skin, grains or sediment, easy to stir. No running or sagging at 1.5 dft	Pass
Fingerprint	-	See 3.2	Pass
Ageing, ISO 20340 - Corrosion at scribe (mm) - Adhesion, ISO 4624 (MPa)	No blister, rusting, flaking or cracking < 7 > 5	No blister, rusting, flaking or cracking 3.0 ± 0.2 12.6 ± 0.3	Pass Pass Pass
Seawater immersion, ISO 20340 (ISO 2812-2) - Corrosion at scribe (mm) - Adhesion, ISO 4624 (MPa)	No blister, rusting, flaking or cracking < 7 > 5	1 or 2 blisters spread on each panel 0.0 mm Not determined	 Pass
Impact Resistance (J) ISO 6272-1	2	> 2	Pass
Overcoatability Shell 2.2.11.5	Topcoat shall be overcoatable for a minimum of 6 months after application	Adhesion ISO 4624 12.9 ± 0.7 MPa	Pass
Touch dry time of the primer Shell 2.2.11.5	Maximum 2 hours	< 2 hours	Pass
Initial Adhesion, ISO 4624 (MPa)	> 7	12.0 ± 1.0	Pass
Total layer thickness (µm)	300	351 ± 24	Pass

CENTRUM VOOR ONDERZOEK
EN TECHNISCH ADVIES (COT)

Dr. B.P. Alblas
Manager Laboratory

J.R.S. Brakenhoff
Technical Manager Laboratory

ANNEX I

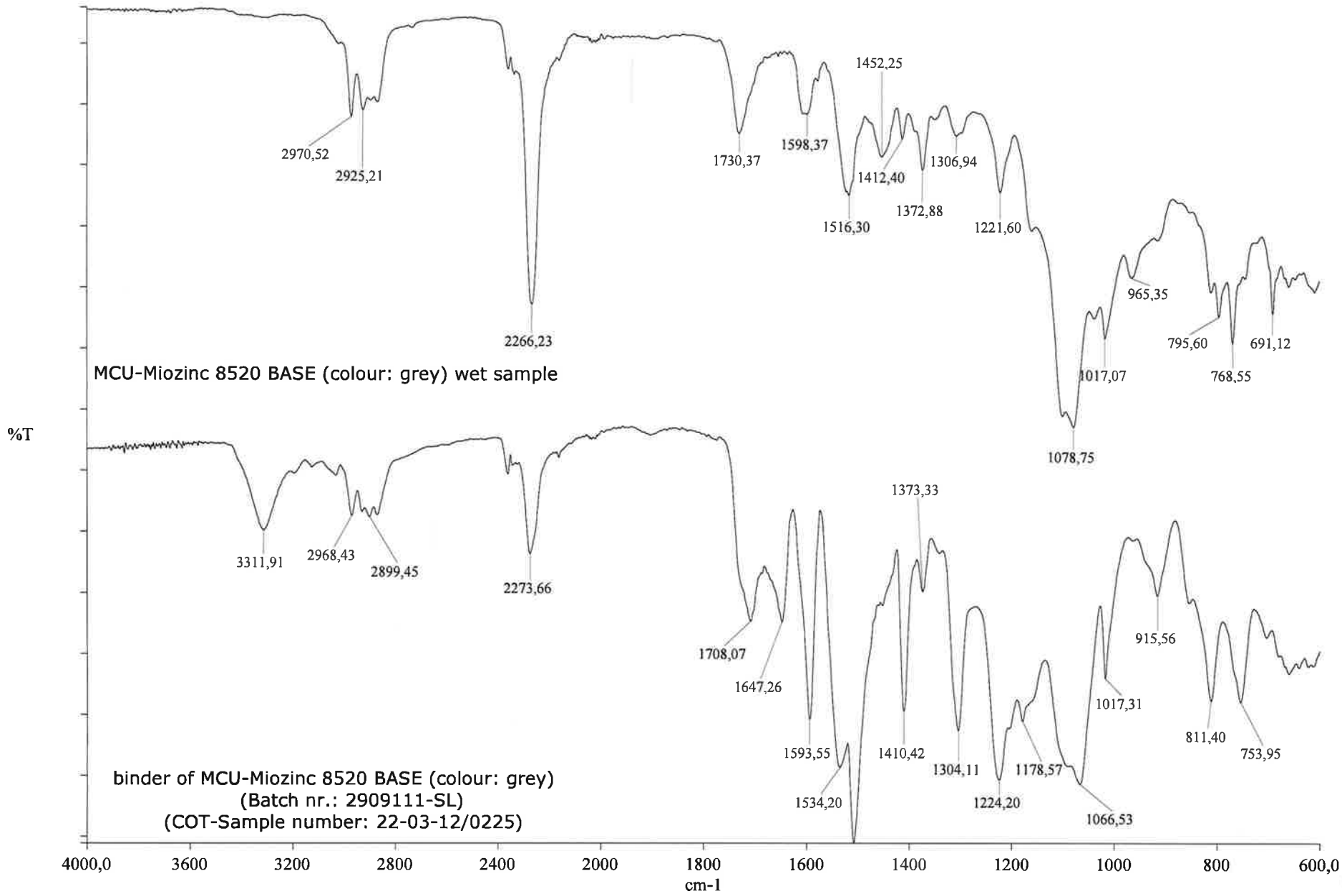
PHOTOS

Photo 1. Cyclic ageing test, panels 2, 3 and 4.

Photo 2. Seawater immersion test, panels 6, 9 and 12

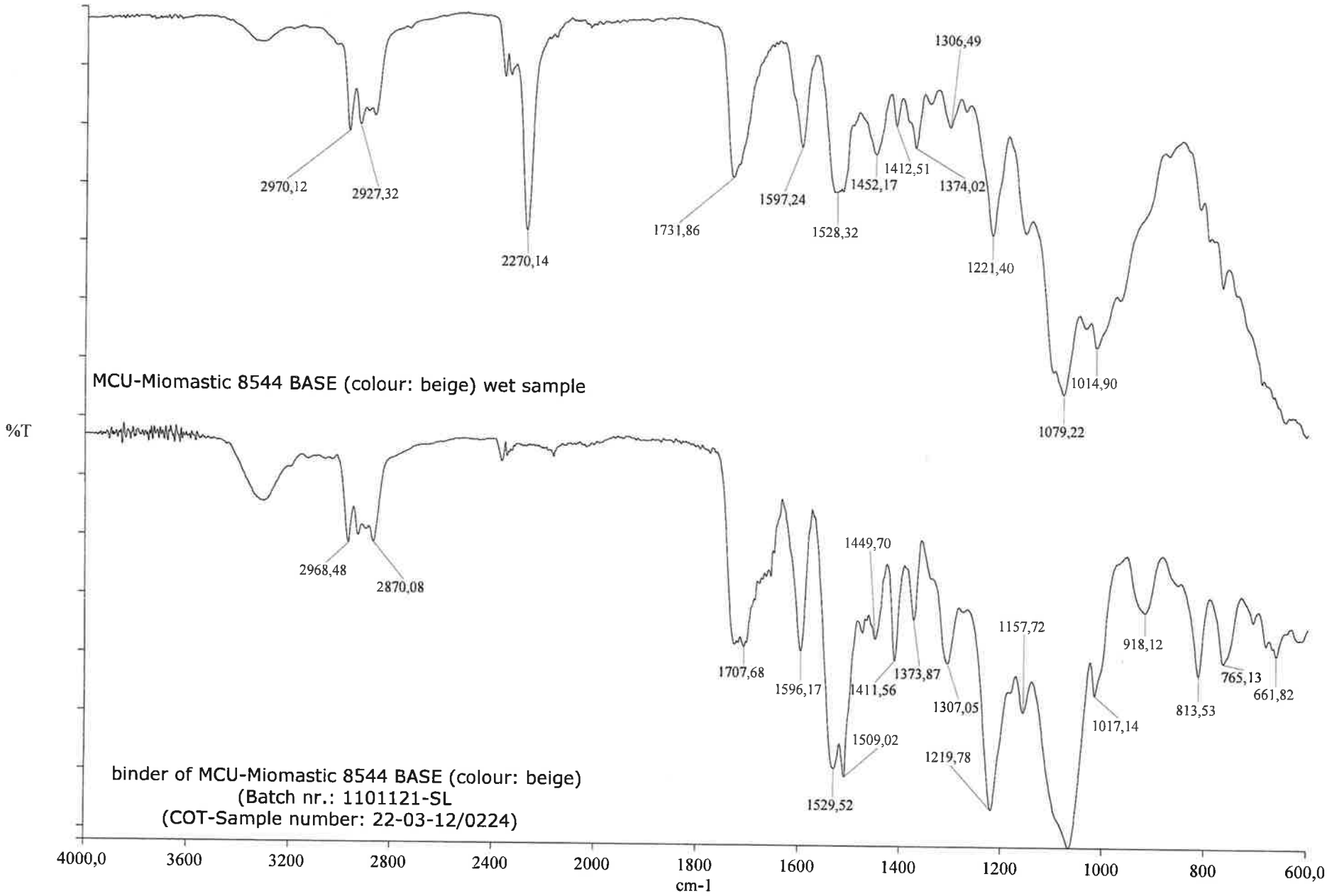
ANNEX II

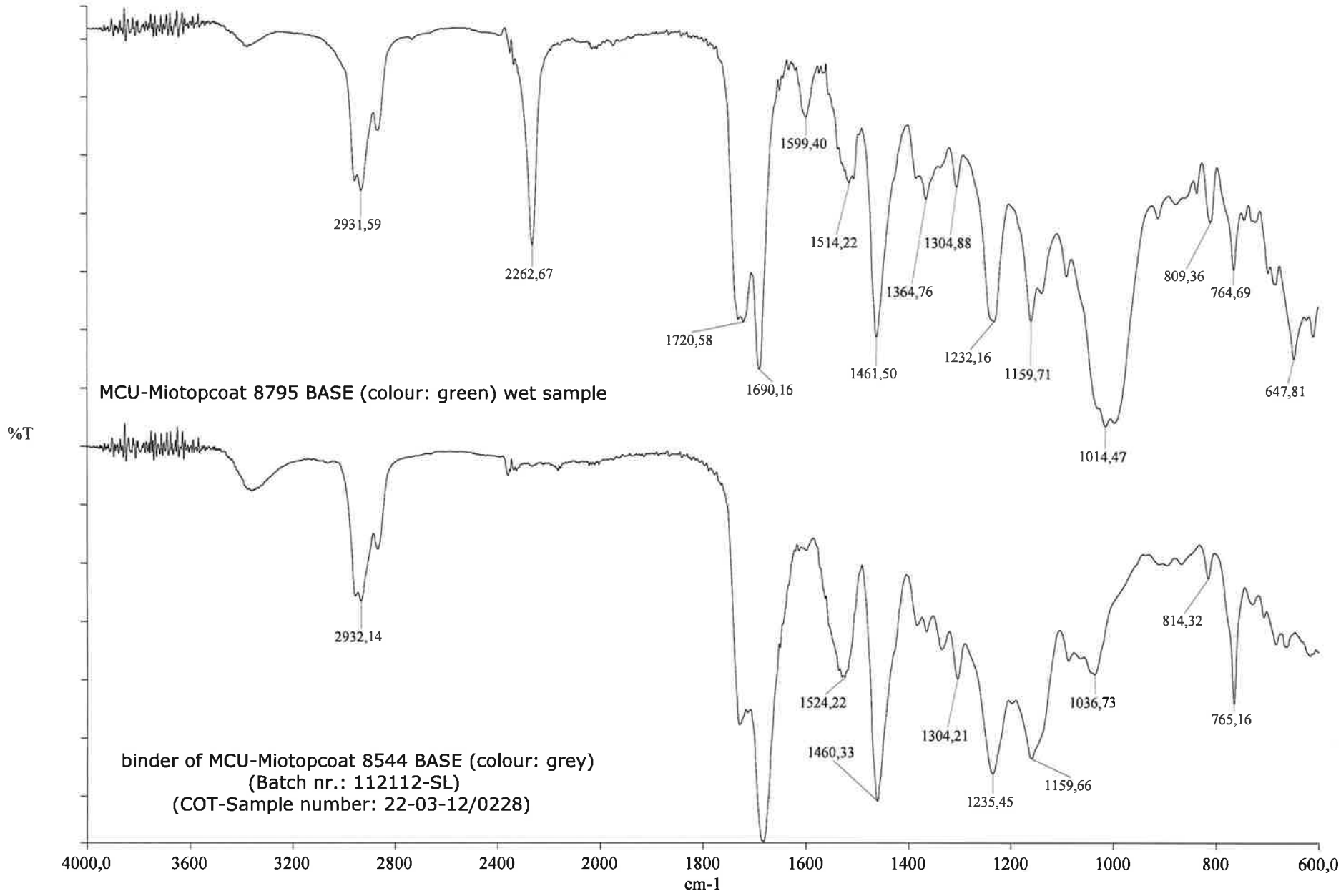
INFRARED SPECTRA



_____ n:\instrumenten\infrar\spectra\2012\12_0225.sp - MCU-Miozinc 8520 (base) (colour: grey) wet sample

_____ n:\instrumenten\infrar\spectra\2012\12_0225_1.sp - binder of MCU-Miozinc 8520


MCU-Miomastic 8544 BASE (colour: beige) wet sample
%T
2970,12
2927,32
2270,14
1731,86
1597,24
1528,32
1452,17
1412,51
1306,49
1374,02
1221,40
1079,22
1014,90
2968,48
2870,08
1707,68
1596,17
1529,52
1509,02
1449,70
1411,56
1373,87
1307,05
1219,78
1157,72
1017,14
918,12
813,53
765,13
661,82
binder of MCU-Miomastic 8544 BASE (colour: beige)
(Batch nr.: 1101121-SL
(COT-Sample number: 22-03-12/0224)
4000,0
3600
3200
2800
2400
2000
1800
1600
1400
1200
1000
800
600,0
cm-1
n:\instrumenten\infrar\spectra\2012\12_0224.sp - MCU-Miomastic 8544 (base) (colour: beige) wet sample
n:\instrumenten\infrar\spectra\2012\12_0224_1.sp - binder of MCU-Miomastic 8544



_____ n:\instrumenten\infrar\spectra\2012\12_0228.sp - MCU-Miotopcoat 8795 (Base) (colour: green) wet sample

_____ n:\instrumenten\infrar\spectra\2012\12_0228_1.sp - binder of MCU-Miotopcoat 8795