Analysis of Particles from Electrostatic Beam Separator EBS#1

TD-04-006

Lori Streit, Unified Engineering
February 21, 2004

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February 21, 2004

Rodger Bossert
Fermi National Accelerator Laboratory
PO Box 500
Batavia, IL 60510

Re: Fermi (Bossert 012204)
Unified Engineering File No. 3053

Dear Mr. Bossert:

This report summarized our examination of the samples you provided to Unified Engineering, Inc. You requested identification of particles on the tape samples. The work was authorized under Fermi Laboratory purchase order no. 555468.

Sample
We received twelve slides containing a tape lift adhered to each slide surface.

Procedure
Each tape lift was examined using darkfield optical microscopy. Sections of the tapes that contained particles of interest were cut away with a blade and transferred to a mount for analysis of elemental composition using scanning electron microscopy with energy dispersive spectrometry detection (SEM/EDS).

Results
See the attached table for a description of the particles observed on each slide, photograph number, and the corresponding SEM/EDS spectrum if taken.

Conclusion
Metal particles identified in the samples included mostly stainless steel, iron, and copper. Aluminum was only found in one sample. There was some mineral and plant tissue. Traces of rust, organic particles, spores and textile fibers were noted.

Respectfully submitted,

Lori A. Streit, Ph.D.
Principal
Chemical and Environmental Science

Enc. 12 figures and 14 photographs

Data for Fermilab Tape Lift Samples

Tape No.	Description	Photo No.	Mag.	EDS	ID
1	ribbon, organic	6892	100X	fig. 1	plant itssue
	silver gray	6893	200X	fig. 2	iron oxide
	silver, 1um in size			fig. 3	stainless steel
	large gray planar	6894	200X	fig. 4	copper oxide
2	large gray planar			fig. 5	copper oxide
3	large copper				copper
4	silver, 1um in size	6896	200X	fig. 8	mostly silicon
	organic brown	6895	200X	fig. 6	carbon, organic
	tan			fig. 7	mineral
5	trace silver metal				
	trace organic				organic
6	fine silver colored	6897			
	dark orange	6898, 6899			rust
	trace copper	6900			copper
	trace plant tissue				
9	many fine silver	6901			
	trace plant tissue				
	one blue cotton fiber				
10	(mixture of organic,	6902			
	copper metal,				
	spores, mineral)				
	tan brown particles			fig. 9	mineral
	silver colored			fig. 10	aluminum
	gray			fig. 11	aluminum
11	copper and plant	6903, 6904			
	copper			fig. 12	copper
12	large organic	6905			
	some fine silver				

D:\EDAX32\EDS\Lori\3053 fermi\3053 Fermi sample 1 plant.spc

Label:3053 Fermi sample 1 - plant tissue

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FS : 2224 Lsec : 24 19-Dec-2003 04:46:16

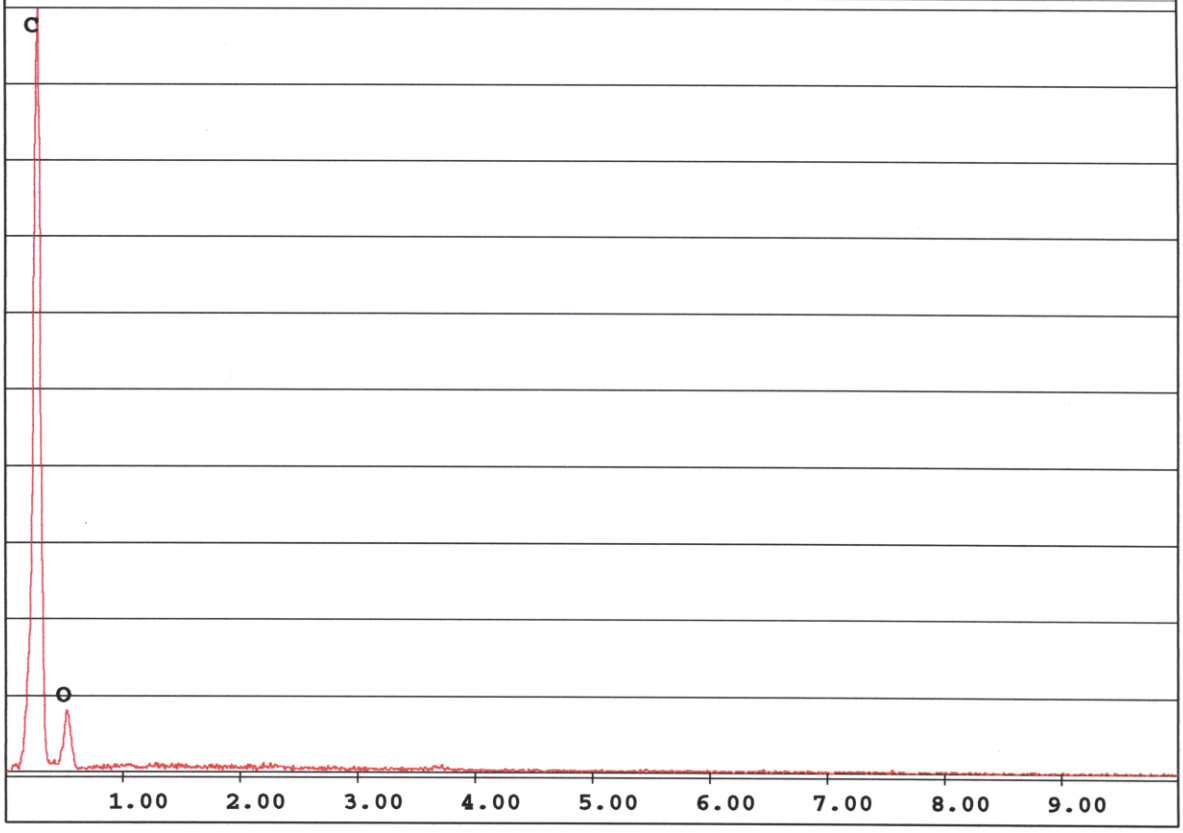
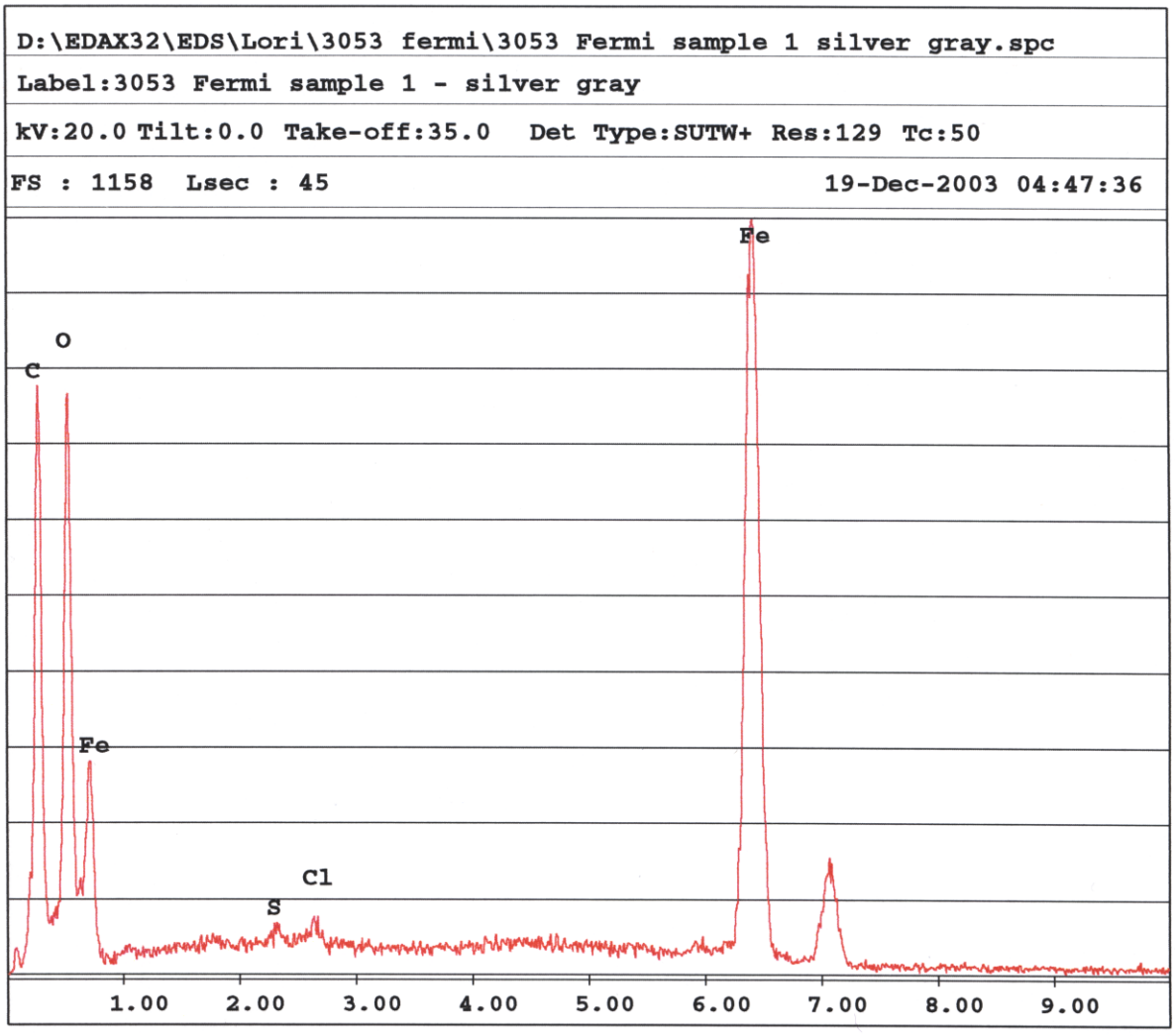


Fig. 1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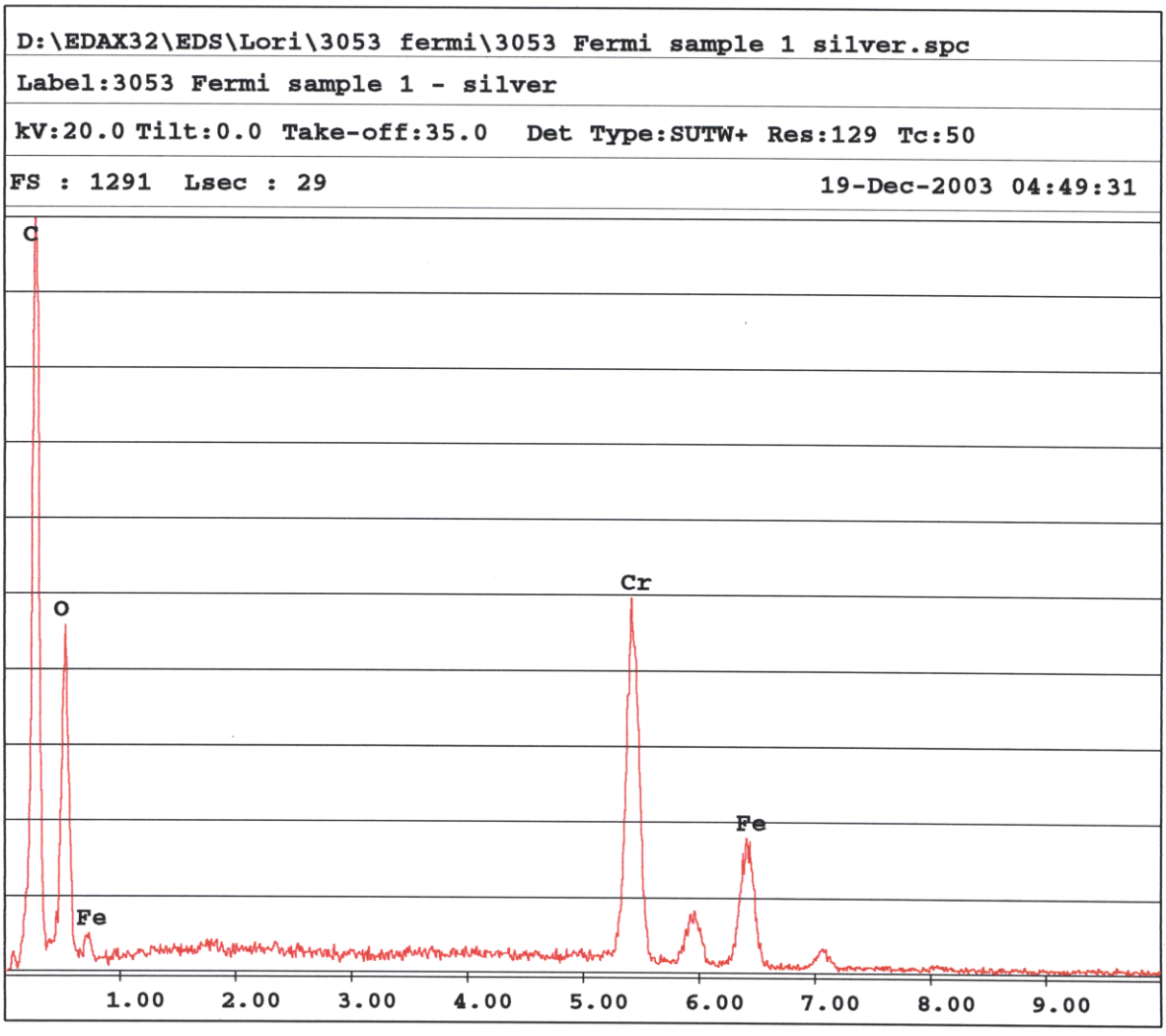
kV:20.0 Tilt:0.0 Take-off:35.0 Det Type:SUTW+ Res:129 Tc:50
FS : 1158 Lsec : 45
19-Dec-2003 04:47:36
Fe
O
C
Fe
Cl
S
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00

Fig. 2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Label:3053 Fermi sample 1 - silver
kV:20.0 Tilt:0.0 Take-off:35.0 Det Type:SUTW+ Res:129 Tc:50
FS : 1291 Lsec : 29
19-Dec-2003 04:49:31
C
O
Fe
Cr
Fe
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00

Fig. 3

D:\EDAX32\EDS\Lori\3053 fermi\3053 Fermi sample 1 gray planar.spc

Label:3053 Fermi sample 1 - large gray planar metallic

kV:20.0 Tilt:0.0 Take-off:35.0 Det Type:SUTW+ Res:129 Tc:50

FS : 2827 Lsec : 39 19-Dec-2003 04:51:37

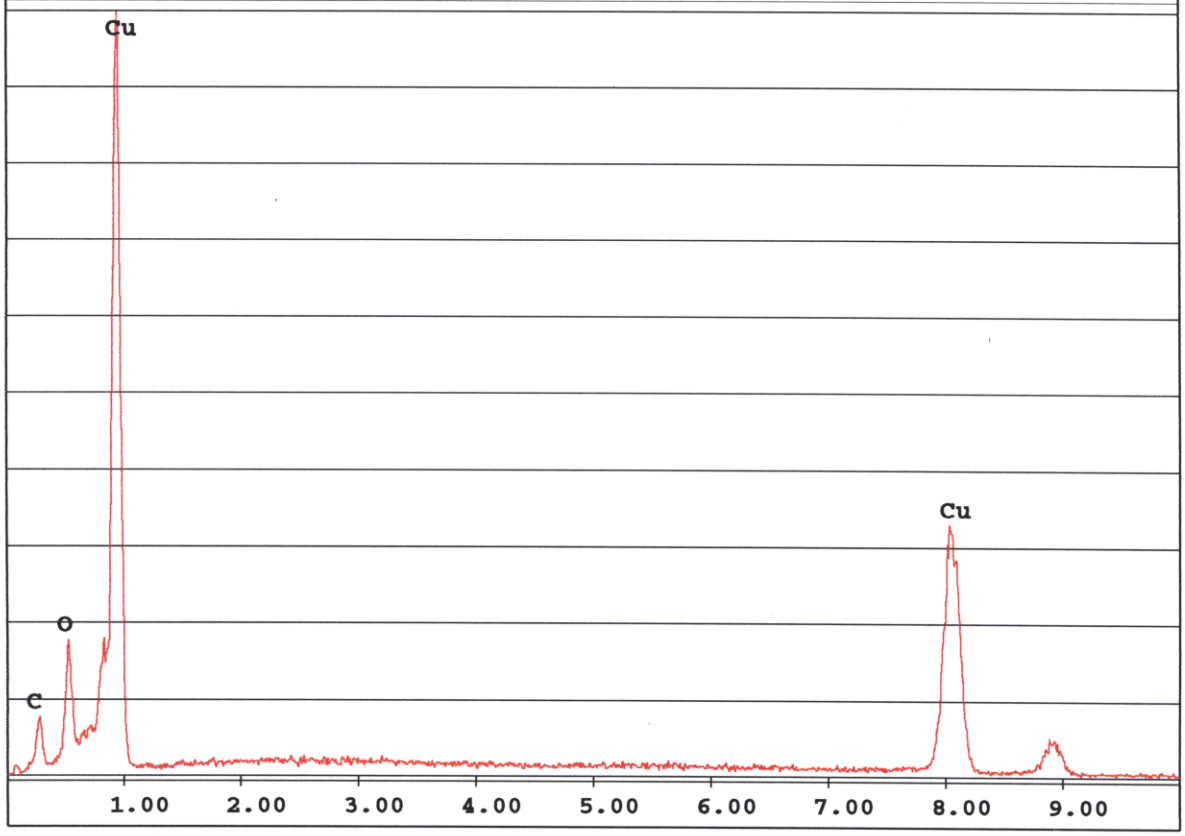
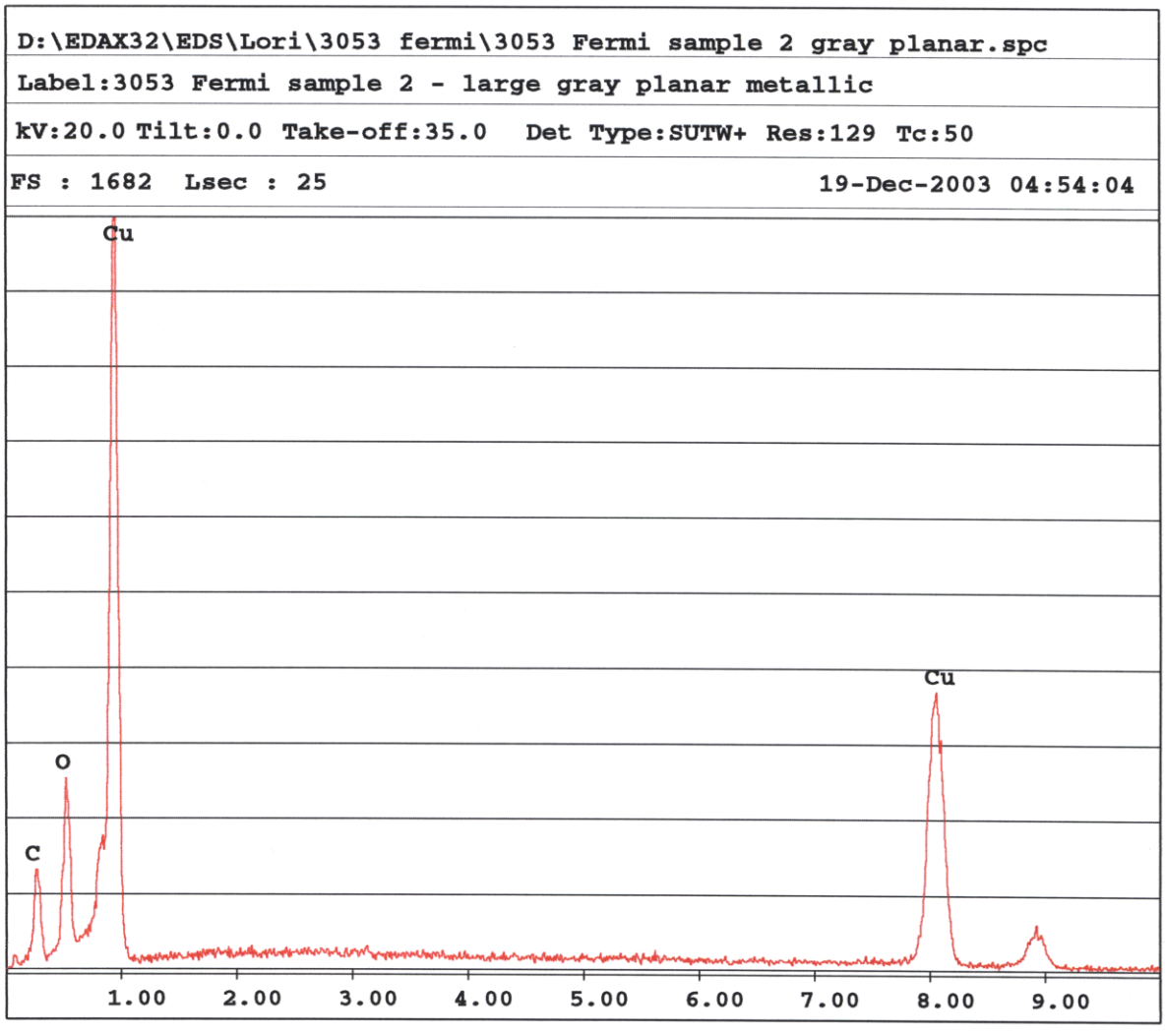


Fig. 4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Label:3053 Fermi sample 2 - large gray planar metallic
kV:20.0 Tilt:0.0 Take-off:35.0 Det Type:SUTW+ Res:129 Tc:50
FS : 1682 Lsec : 25
19-Dec-2003 04:54:04
Cu
Cu
O
C
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00

Fig. 5

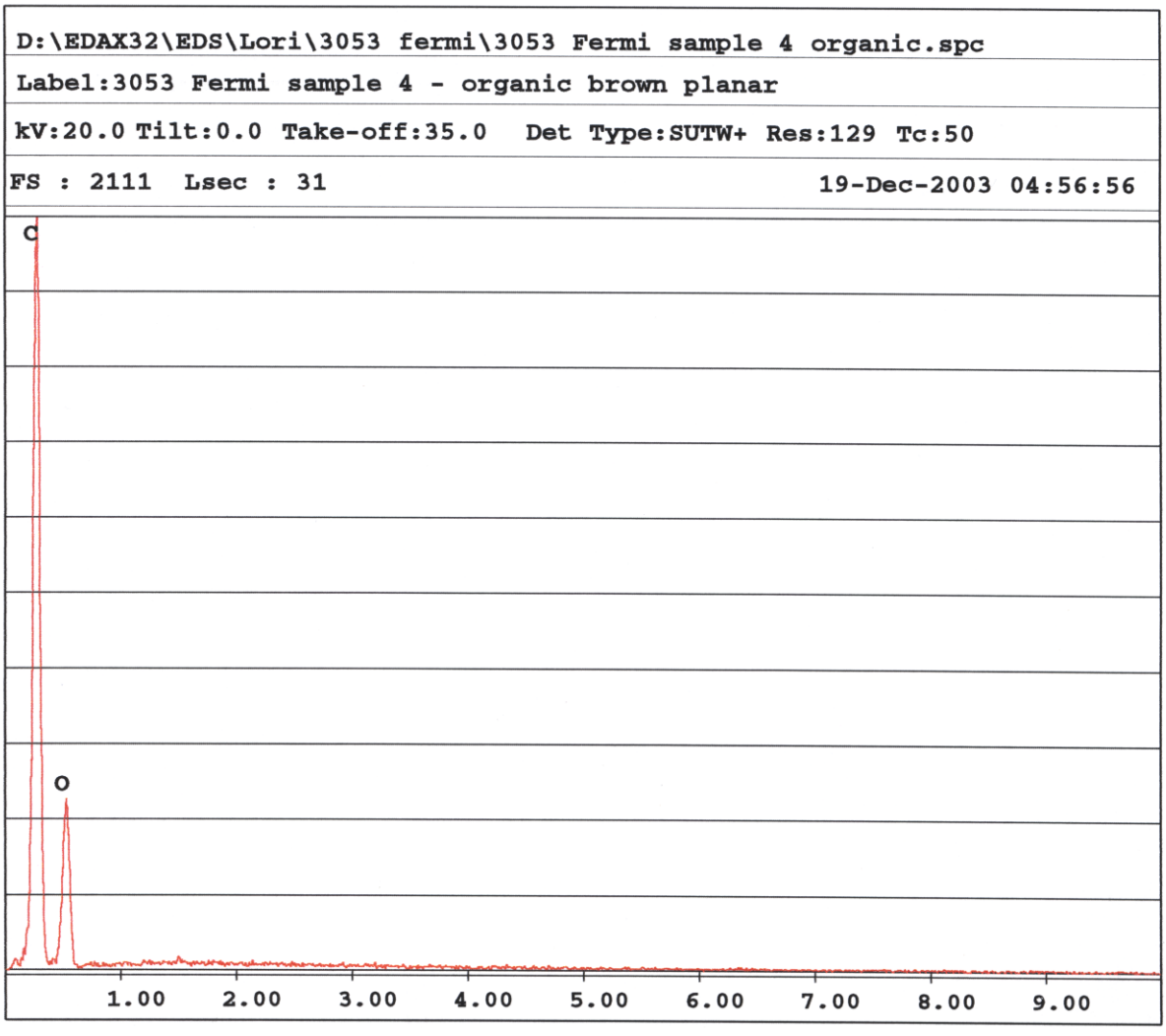

D:\EDAX32\EDS\Lori\3053 fermi\3053 Fermi sample 4 organic.spc
Label:3053 Fermi sample 4 - organic brown planar
kV:20.0 Tilt:0.0 Take-off:35.0 Det Type:SUTW+ Res:129 Tc:50
FS : 2111 Lsec : 31
19-Dec-2003 04:56:56
C
O
1.00
2.00
3.00
4.00
5.00
6.00
7.00
8.00
9.00

Fig. 6

D:\EDAX32\EDS\Lori\3053 fermi\3053 Fermi sample 4 tan copper.spc

Label:3053 Fermi sample 4 - tan copper colored

kV:20.0 Tilt:0.0 Take-off:35.0 Det Type:SUTW+ Res:129 Tc:50

FS : 2426 Lsec : 39 19-Dec-2003 04:58:08

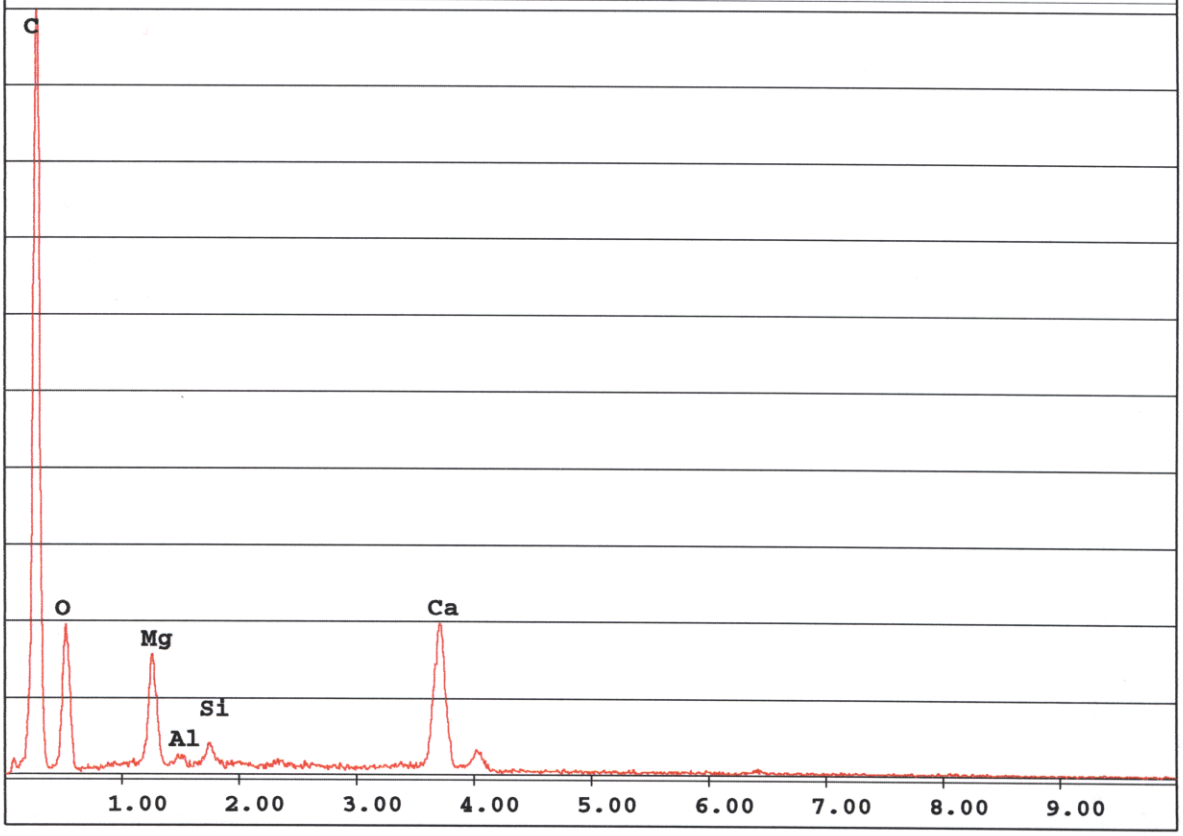


Fig. 7

D:\EDAX32\EDS\Lori\3053 fermi\3053 Fermi sample 4 silver.spc

Label:3053 Fermi sample 4 - silver color

kV:20.0 Tilt:0.0 Take-off:35.0 Det Type:SUTW+ Res:129 Tc:50

FS : 2307 Lsec : 44 19-Dec-2003 05:02:09

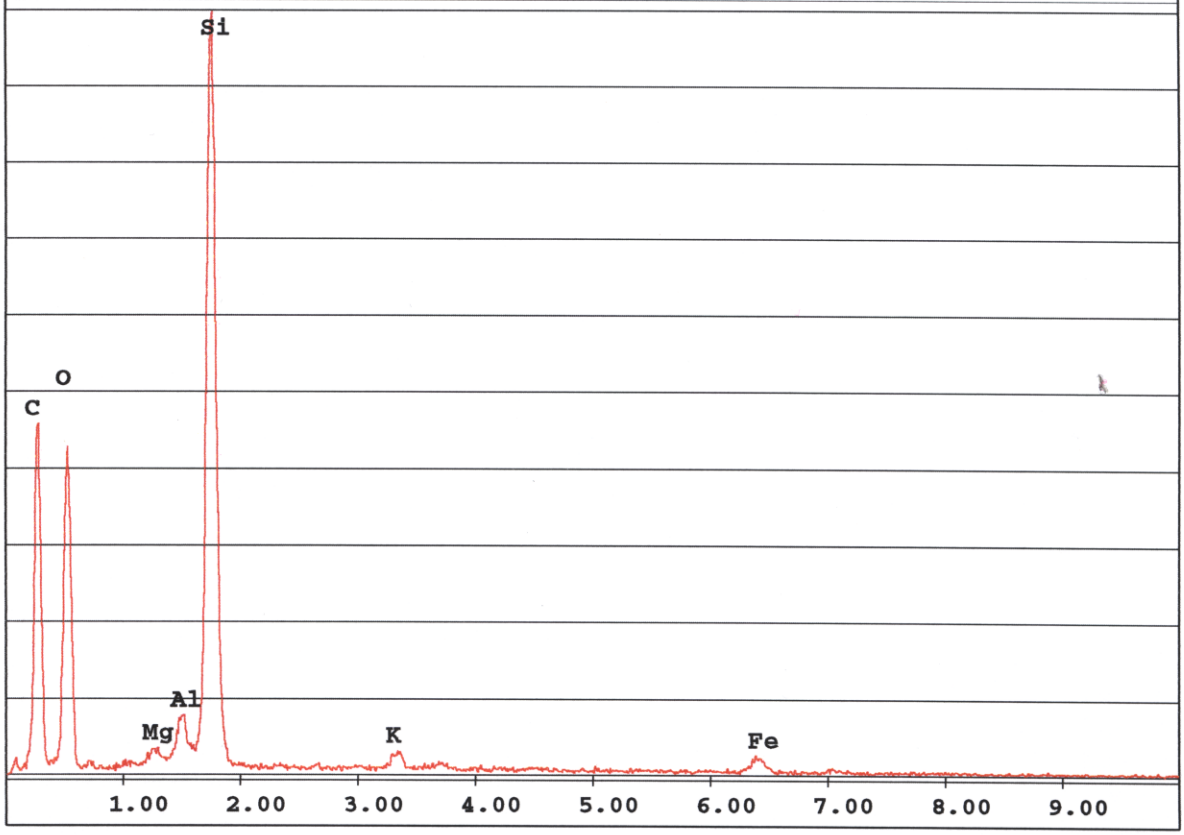


Fig. 8

D:\EDAX32\EDS\Lori\3053 fermi\3053 Fermi sample 10 tan brown.spc

Label:3053 Fermi sample 10 - tan brown

kV:20.0 Tilt:0.0 Take-off:35.0 Det Type:SUTW+ Res:129 Tc:50

FS : 2174 Lsec : 39 19-Dec-2003 05:09:32

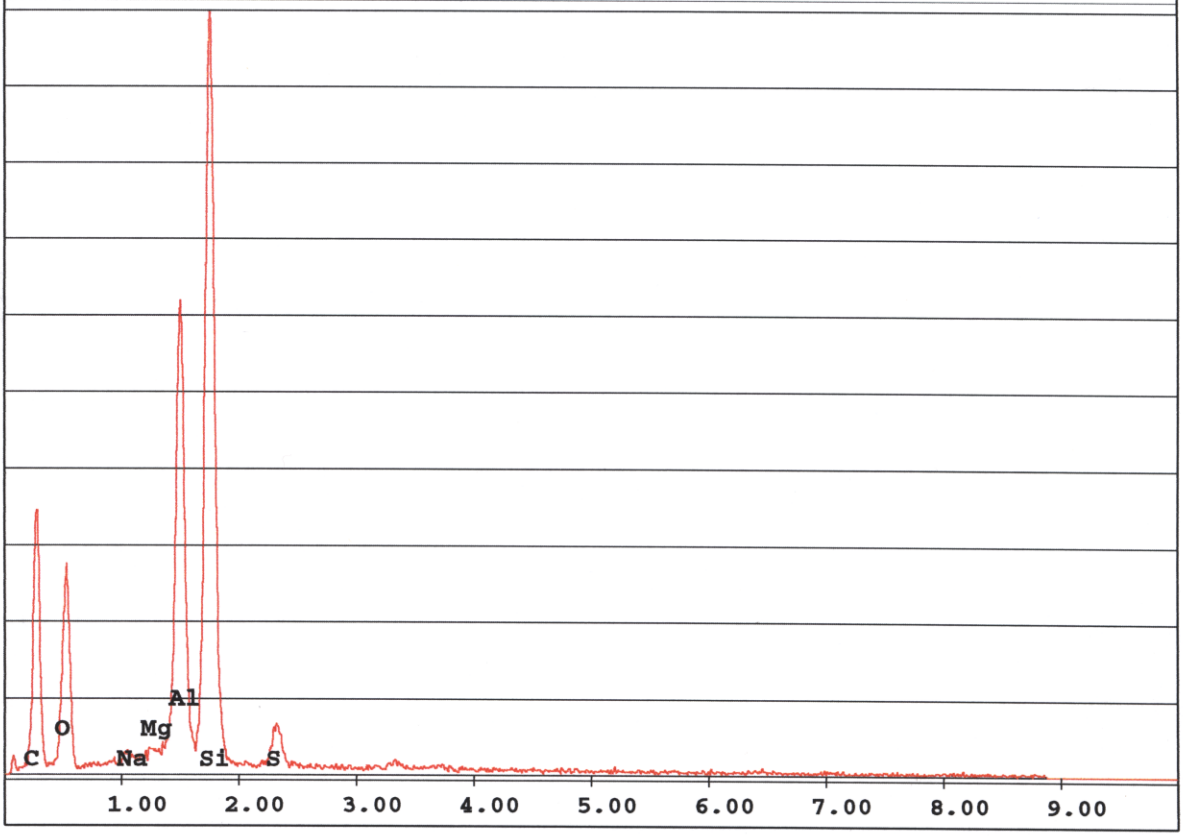
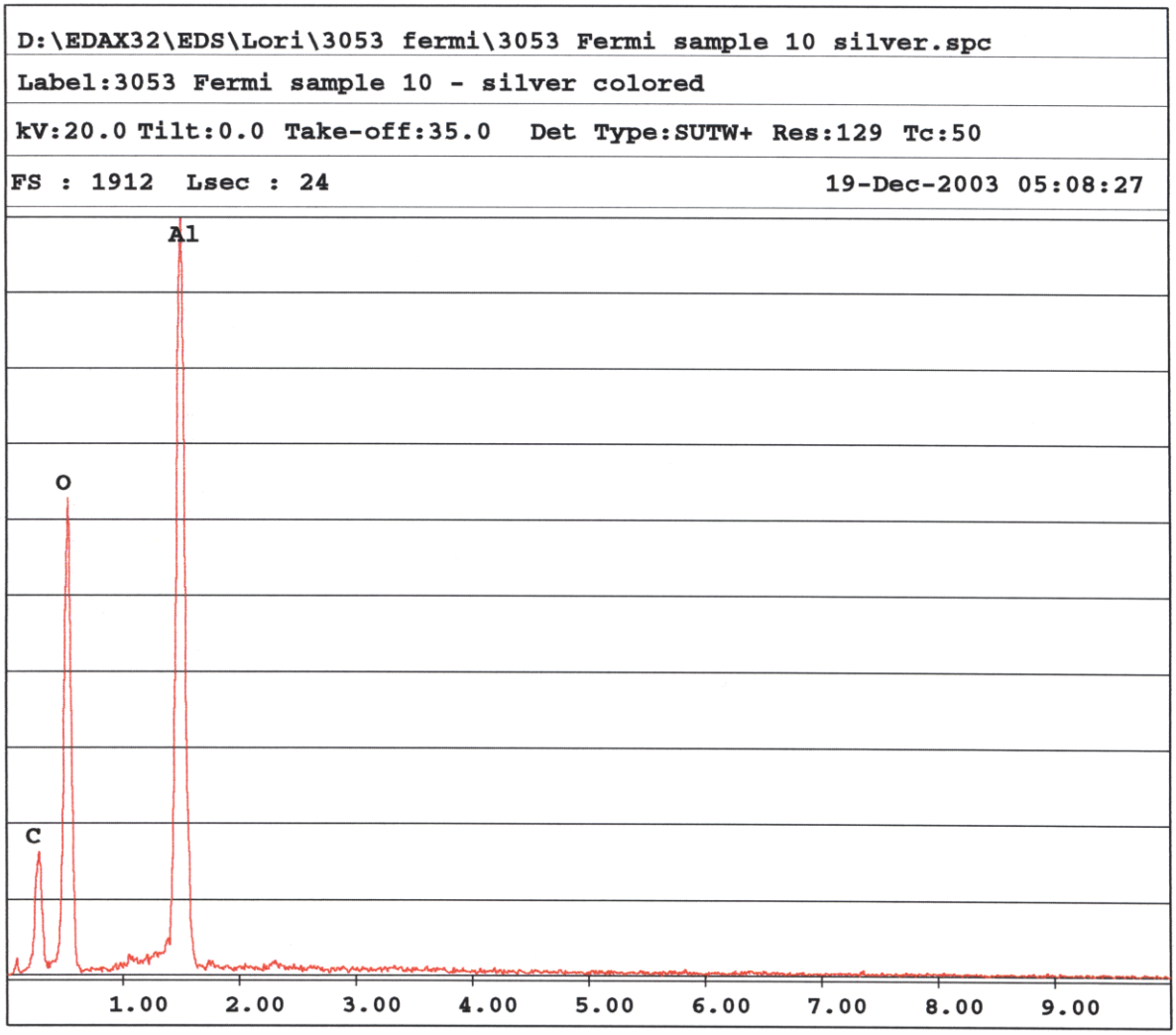


Fig 9


D:\EDAX32\EDS\Lori\3053 fermi\3053 Fermi sample 10 silver.spc
Label:3053 Fermi sample 10 - silver colored
kV:20.0 Tilt:0.0 Take-off:35.0 Det Type:SUTW+ Res:129 Tc:50
FS : 1912 Lsec : 24
19-Dec-2003 05:08:27
Al
O
C
1.00
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6.00
7.00
8.00
9.00

Fig. 10

D:\EDAX32\EDS\Lori\3053 fermi\3053 Fermi sample 10 gray.spc

Label:3053 Fermi sample 10 - gray

kV:20.0 Tilt:0.0 Take-off:35.0 Det Type:SUTW+ Res:129 Tc:50

FS : 1126 Lsec : 29 19-Dec-2003 05:10:56

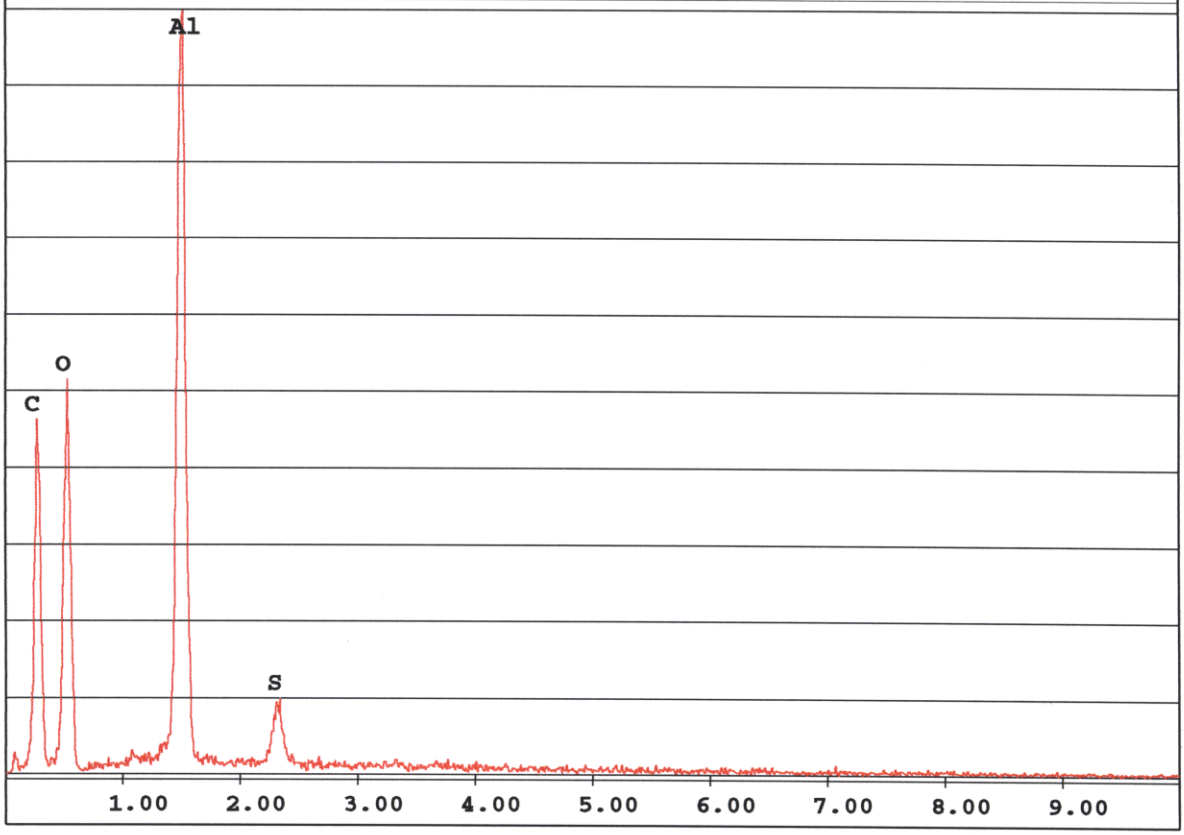


Fig. 11

D:\EDAX32\EDS\Lori\3053 fermi\3053 Fermi sample 11copper.spc

Label:3053 Fermi sample 11 - copper colored

kV:20.0 Tilt:0.0 Take-off:35.0 Det Type:SUTW+ Res:129 Tc:50

FS : 1007 Lsec : 29 19-Dec-2003 05:13:35

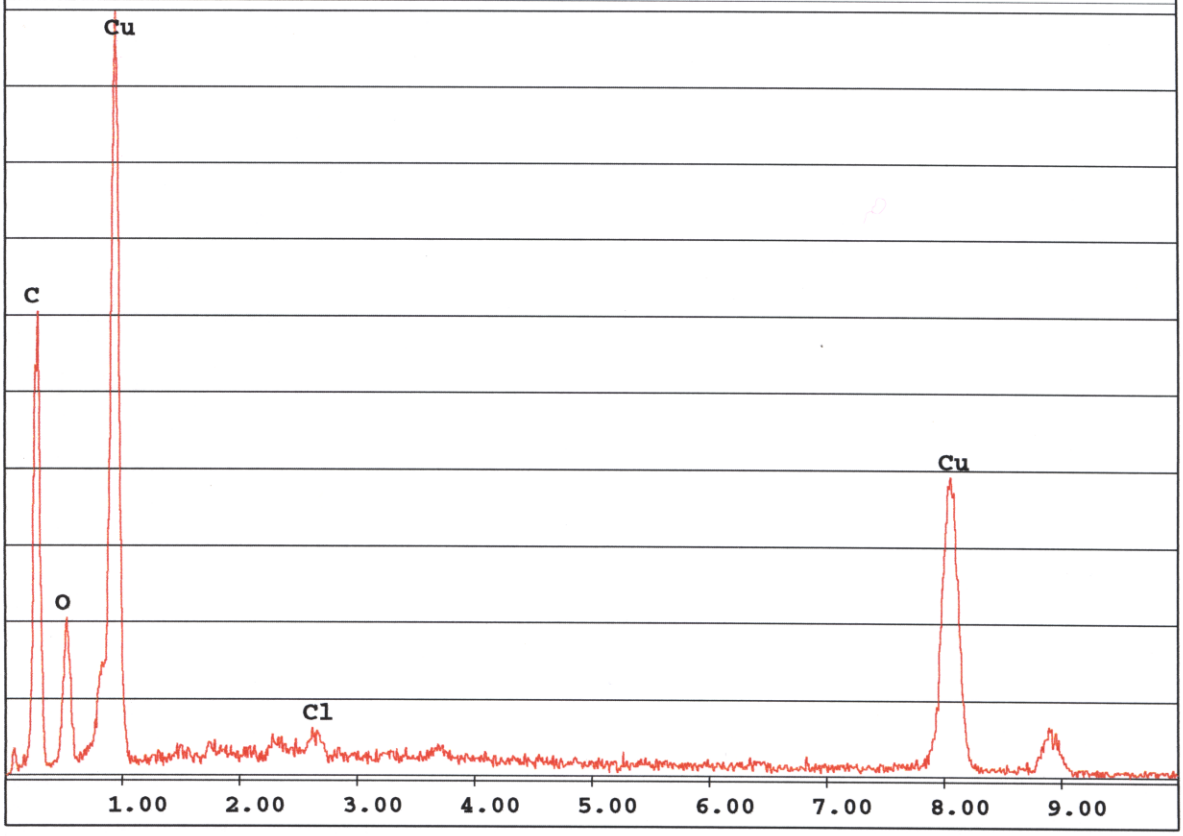
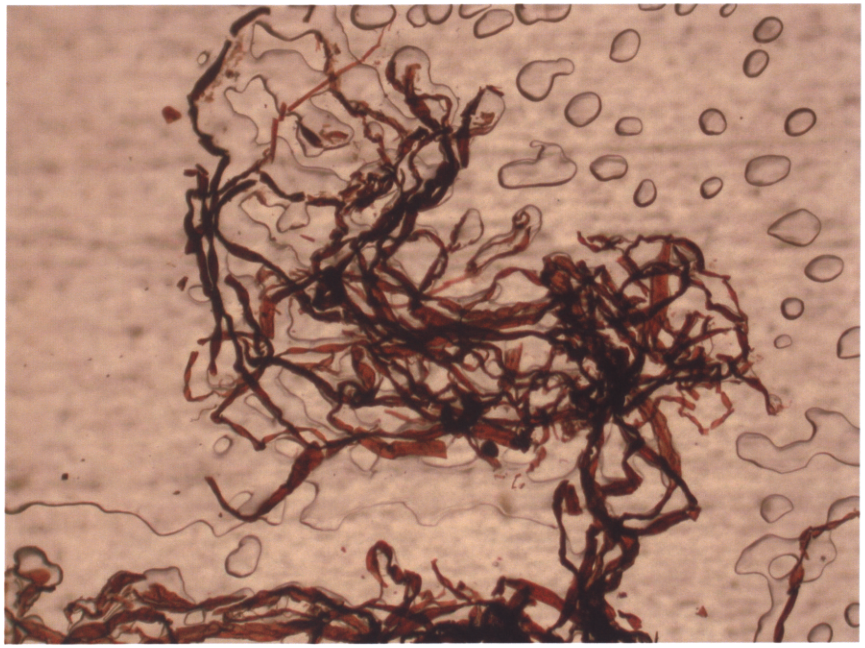


Fig. 11

Job 3053 Fermi Particles

January 23, 2004



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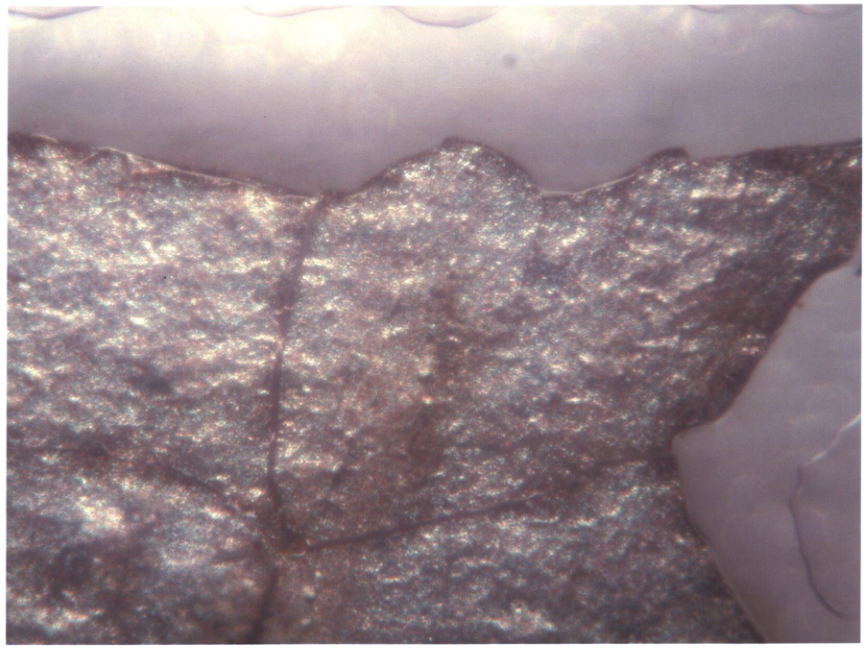

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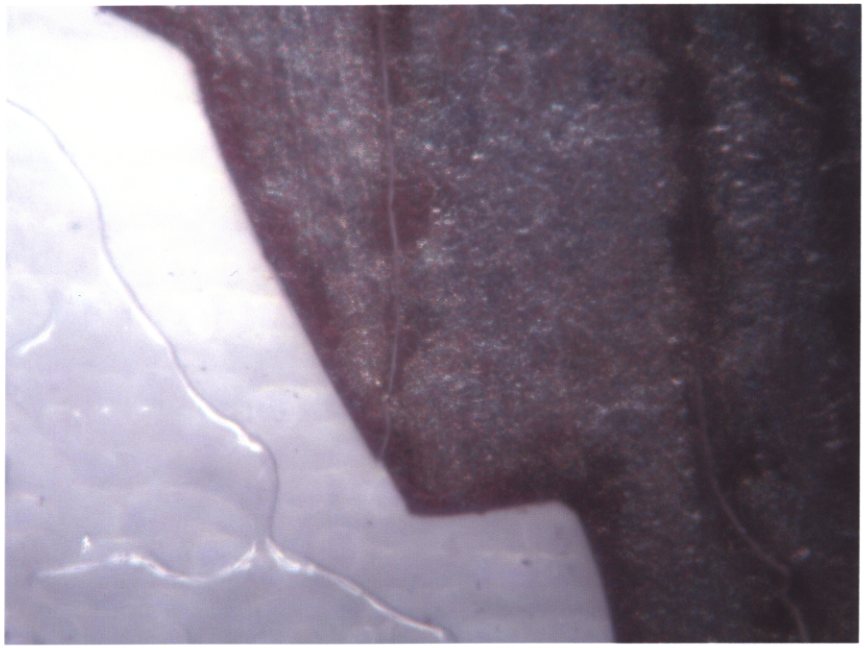

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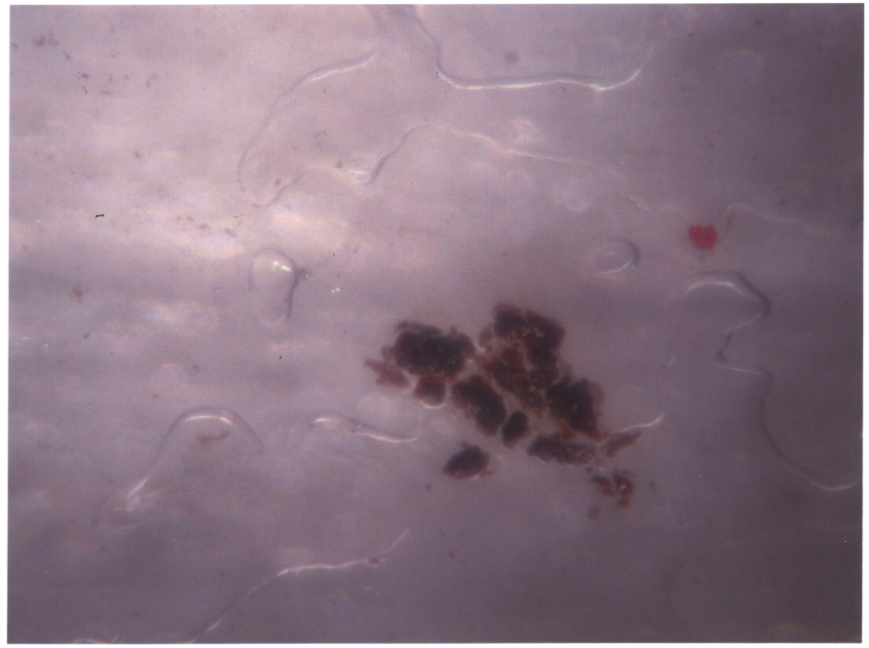

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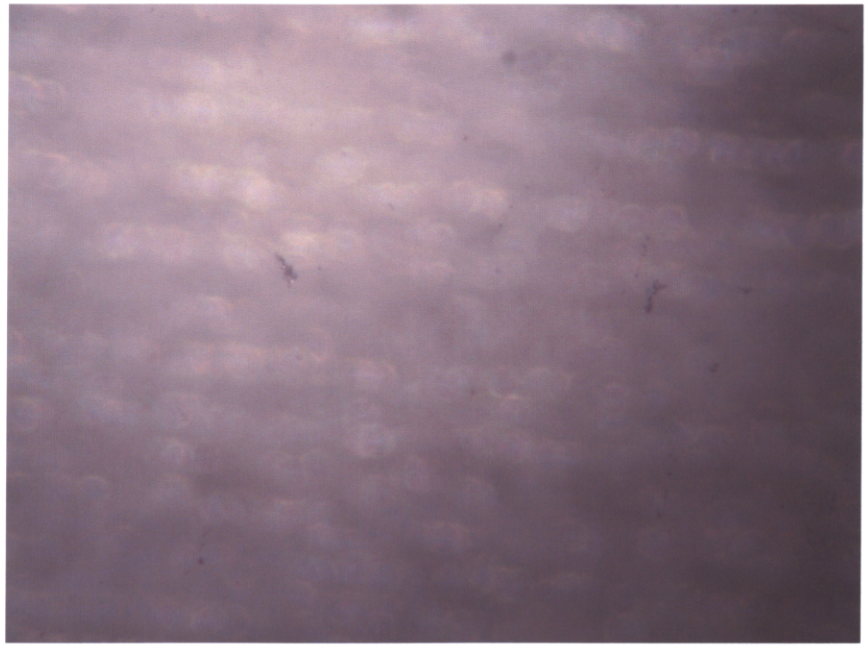
Job 3053 Fermi Particles

January 23, 2004



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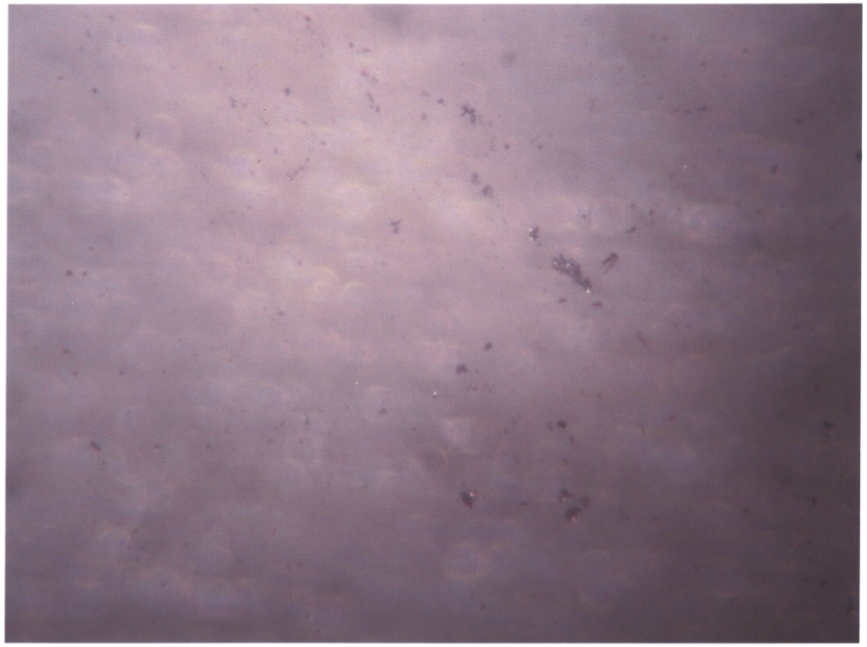

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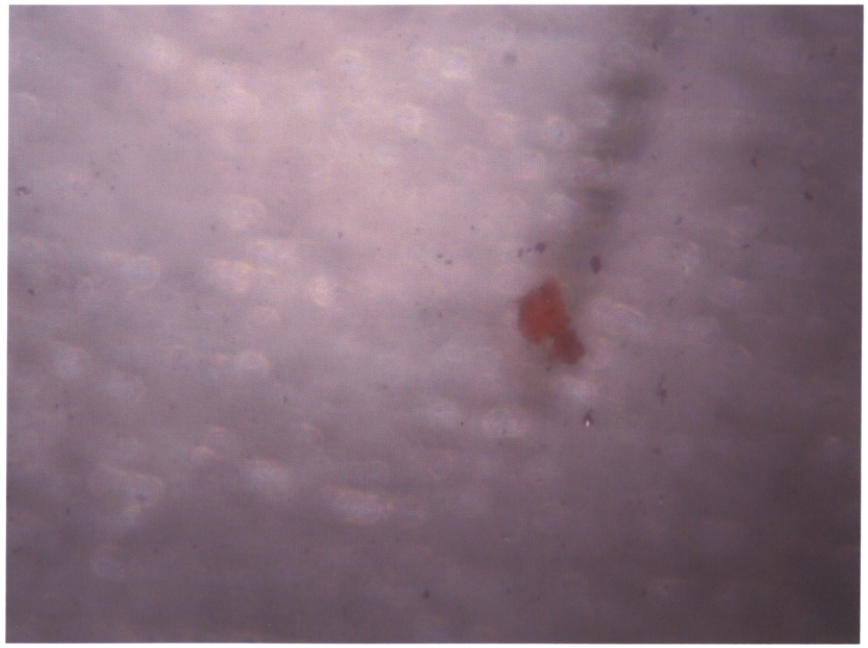

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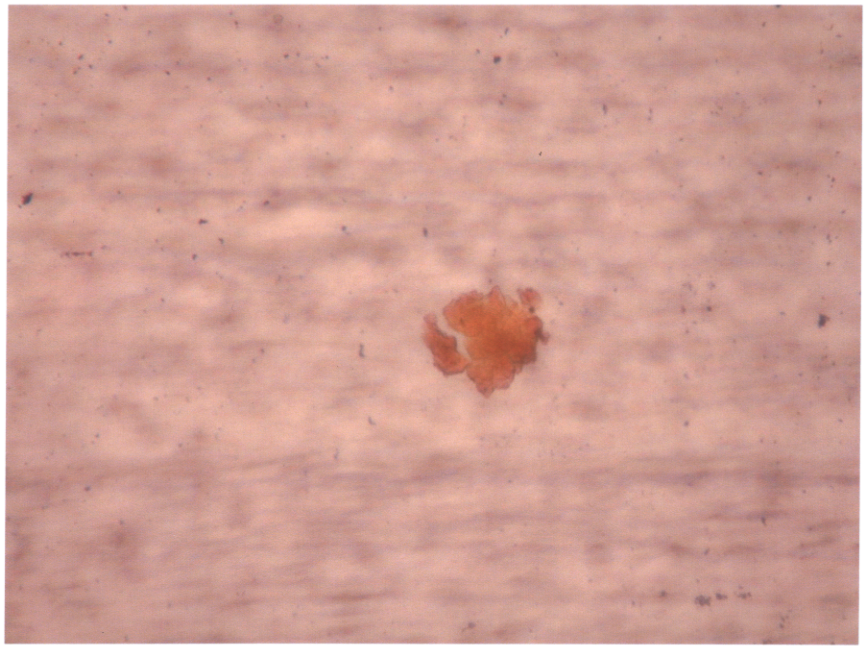

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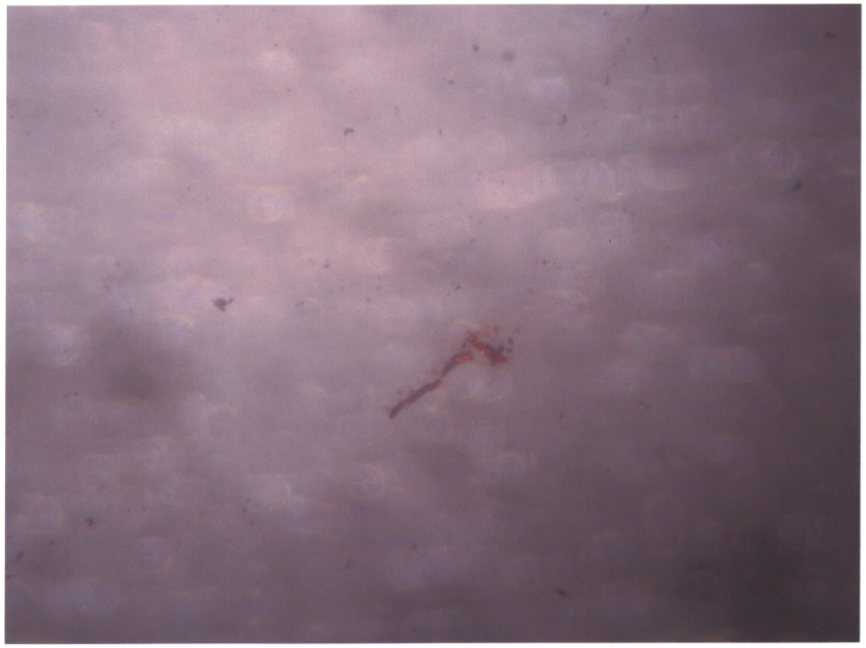
Job 3053 Fermi Particles

January 23, 2004



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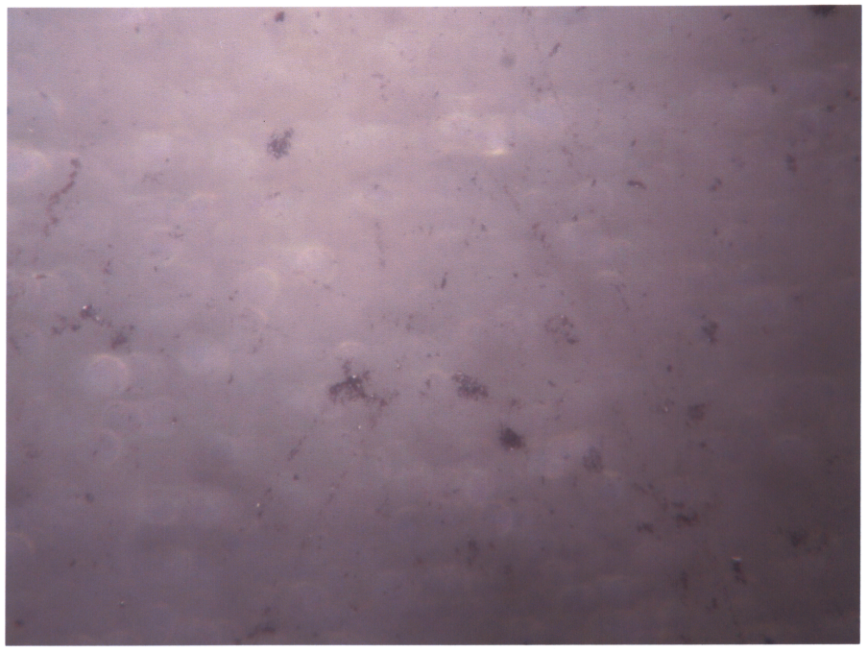

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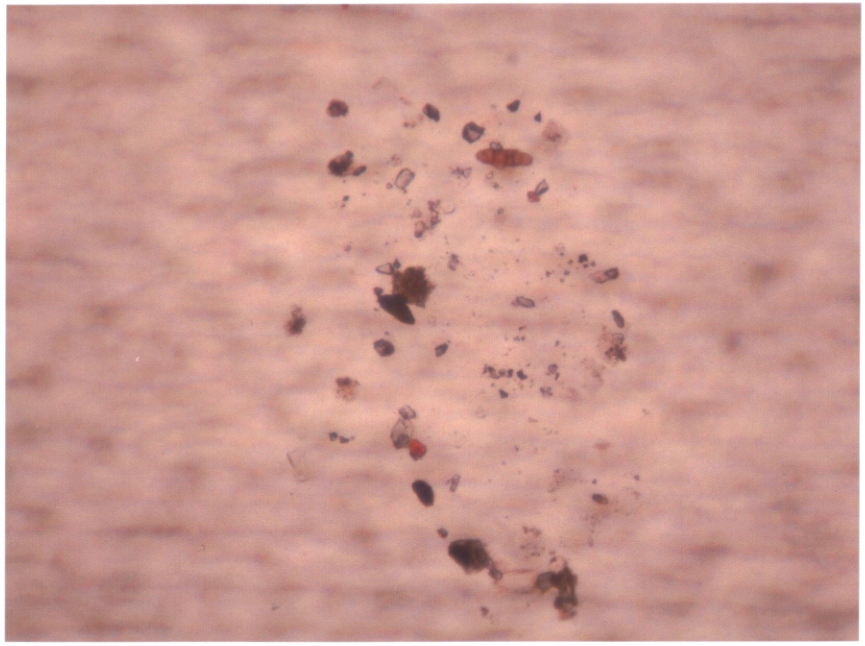

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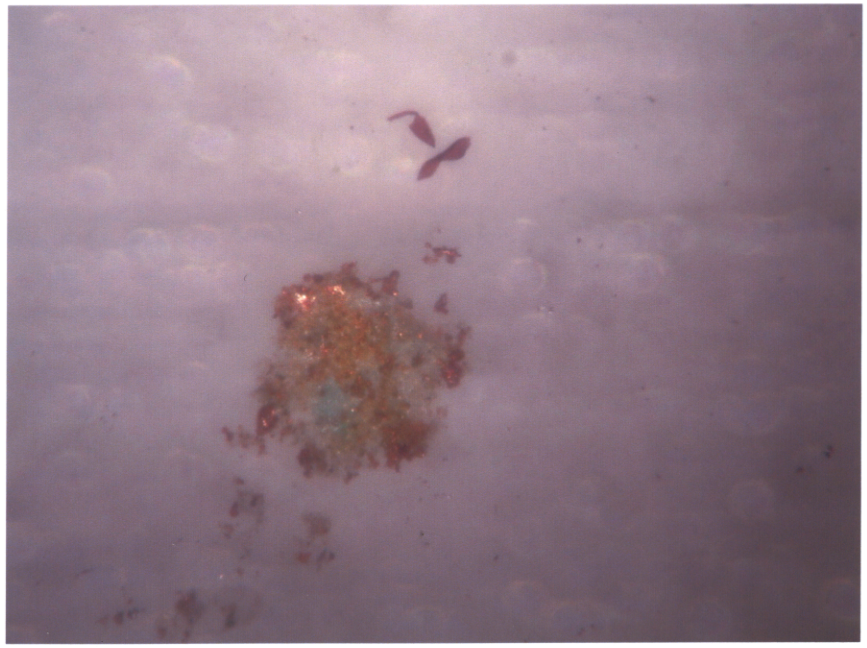

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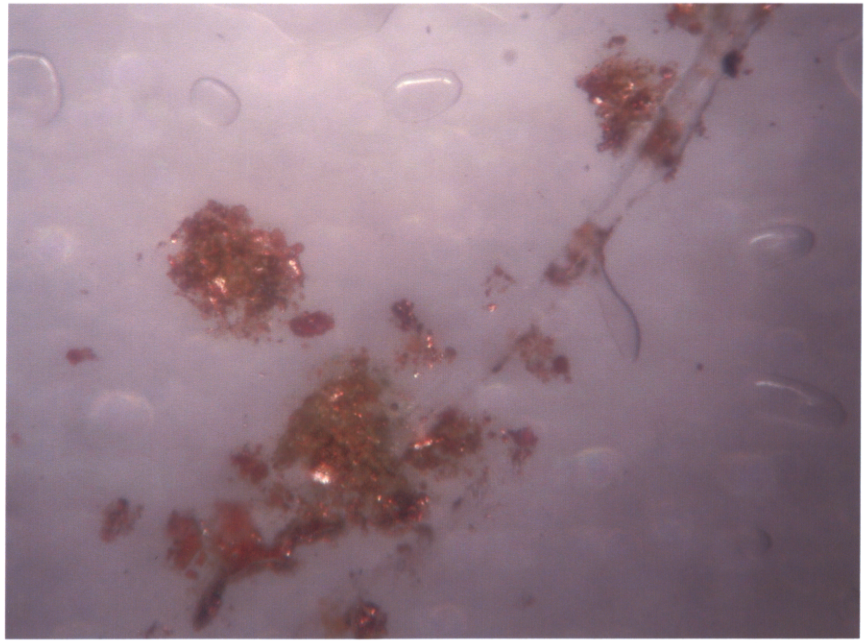
Job 3053 Fermi Particles

January 23, 2004



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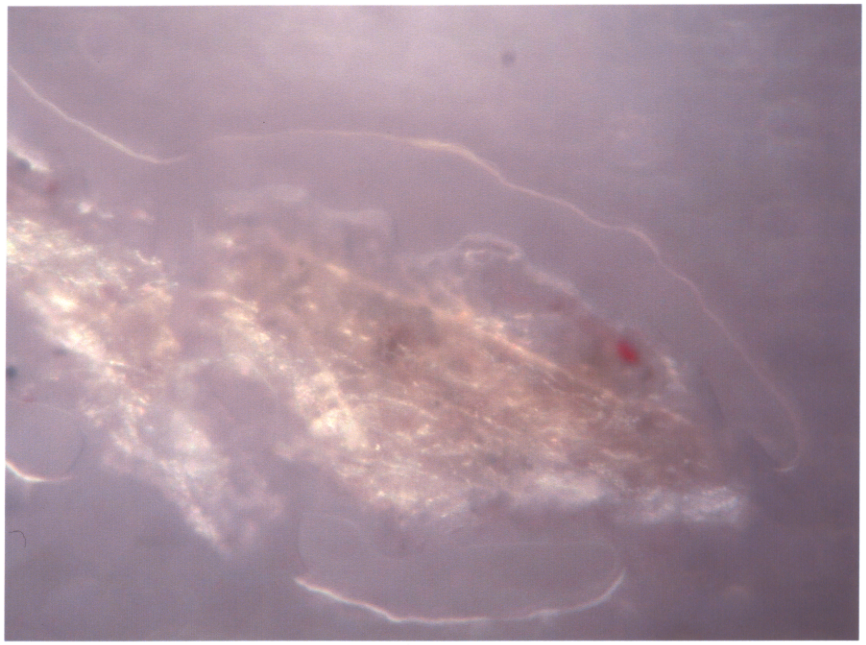

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