RESULTS

Carbon region C1s

Surface	Eb (eV)	Component	Ratio %
Au	286,1	CH_2-S- / CH-NH_2	68
Au	288,9	COOH /COO^-	32
Cu	285,8	CH_2-S- / CH-NH_2	73
Cu	288,4	COOH /COO^-	27
Pyrite	286,1	CH_2-S- / CH-NH_2	72
Pyrite	288,8	COOH /COO^-	28

Oxygen region O1s

Surface	Eb (eV)	Component	Ratio %
Au	531,6	COO^-	100
Cu	531,6	COO^-	100
Pyrite	532	COO^-	62
Pyrite	533,8	COOH	38

Nitrogen region N1s

Form	Surface	Eb (eV)	Component	Ratio %
zwitterion	Au	401,7	NH_3^+	100
Anion	Cu	399,9	NH_2	100
Anion	Pyrite	400	NH_2	62
Cation	Pyrite	402,2	NH_3^+	38

O 1s and N 1s regions present the most significant differences

1
00:00:13,119 --> 00:00:11,020
hi good morning my name is Maria and

2
00:00:17,609 --> 00:00:13,129
working in astrobiology Center in Madrid

3
00:00:22,929 --> 00:00:17,619
Spain and I enjoy my peace dee derp my

4
00:00:25,870 --> 00:00:22,939
studies my research is about amino acids

5
00:00:28,269 --> 00:00:25,880
on different surfaces and I use

6
00:00:31,779 --> 00:00:28,279
different inspectors copy and microscopy

7
00:00:34,990 --> 00:00:31,789
techniques in this talk I'm going to

8
00:00:37,570 --> 00:00:35,000
subdue a a comparison of amino acids

9
00:00:42,369 --> 00:00:37,580
reactivity of minerals in opposition to

10
00:00:46,029 --> 00:00:42,379
metal surfaces okay the main objective

11
00:00:48,310 --> 00:00:46,039
of my study is try to explain hold a

12
00:00:51,369 --> 00:00:48,320
simple organic and inorganic molecules

13
00:00:54,369 --> 00:00:51,379

like amino acids or gases through

14
00:00:57,670 --> 00:00:54,379
chemical reaction on possibles possible

15
00:01:02,799 --> 00:00:57,680
cut catalyzed become complex organic

16
00:01:05,229 --> 00:01:02,809
molecules the amino acids and metal ions

17
00:01:10,660 --> 00:01:05,239
are present in the night or in different

18
00:01:14,350 --> 00:01:10,670
place cool arrived to the earth from the

19
00:01:16,900 --> 00:01:14,360
meteorite the meteorites are rich source

20
00:01:20,499 --> 00:01:16,910
of amino acids and metal ions like

21
00:01:23,580 --> 00:01:20,509
nickel iron magnesium and they are

22
00:01:26,589 --> 00:01:23,590
present too in either tremor systems and

23
00:01:28,990 --> 00:01:26,599
the chemical interaction of amino acids

24
00:01:32,880 --> 00:01:29,000
with metal ions is essential in many

25
00:01:39,479 --> 00:01:32,890
biological processes for example metal

26
00:01:45,580 --> 00:01:42,510
the amino acids are the biological

27
00:01:47,320 --> 00:01:45,590
building blocks and they are essential

28
00:01:49,839 --> 00:01:47,330
for the formation of the proteins and

29
00:01:52,960 --> 00:01:49,849
they have an important role in molecular

30
00:01:55,410 --> 00:01:52,970
biology medicine and biochemistry they

31
00:01:59,350 --> 00:01:55,420
provide two different functional groups

32
00:02:02,350 --> 00:01:59,360
acid group an amino group and son amino

33
00:02:06,100 --> 00:02:02,360
acids also have a degenerative groups

34
00:02:09,669 --> 00:02:06,110
like super or aromatic rings dead

35
00:02:12,550 --> 00:02:09,679
chemical forms can be neutral anionic

36
00:02:18,270 --> 00:02:12,560
cationic or city should do it ironic

37
00:02:19,730 --> 00:02:18,280
chemical for quick the Nutri the anionic

38
00:02:22,430 --> 00:02:19,740

chemical for

39
00:02:25,910 --> 00:02:22,440
has amino group and Karis elite group

40
00:02:29,540 --> 00:02:25,920
the cationic chemical for has a

41
00:02:33,590 --> 00:02:29,550
protonate amino group and acid group and

42
00:02:36,130 --> 00:02:33,600
sweet ironic chemical fir has a briton

43
00:02:41,150 --> 00:02:36,140
eight amino group and carboxylate group

44
00:02:44,840 --> 00:02:41,160
in my experiment I have you seen 15

45
00:02:48,770 --> 00:02:44,850
amino acid 15 is the dimer of the amino

46
00:02:50,900 --> 00:02:48,780
acids 15 and it had to 15 covalently

47
00:02:54,380 --> 00:02:50,910
linked to make a distal fight born and

48
00:02:58,460 --> 00:02:54,390
it has five creative group to an acid

49
00:03:04,400 --> 00:02:58,470
acid group and two amino group and it

50
00:03:07,330 --> 00:03:04,410
has a distal fat bone in my experiment

51
00:03:10,340 --> 00:03:07,340
we have used it three different surfaces

52
00:03:14,240 --> 00:03:10,350
to metal surfaces they are gold and

53
00:03:17,810 --> 00:03:14,250
copper and one mineral surface it is a

54
00:03:21,410 --> 00:03:17,820
pirate mineral and all them they are

55
00:03:24,020 --> 00:03:21,420
single crystal several theories have

56
00:03:27,170 --> 00:03:24,030
proposed the mineral as a possible site

57
00:03:29,480 --> 00:03:27,180
for absorption of amino acid and San

58
00:03:32,150 --> 00:03:29,490
amino acids are very strongly acerbic by

59
00:03:34,820 --> 00:03:32,160
some mineral surfaces this absorption

60
00:03:37,940 --> 00:03:34,830
will have a silly title but tight

61
00:03:41,060 --> 00:03:37,950
formation by increasing the effective

62
00:03:44,060 --> 00:03:41,070
concentration of amino acid on catalytic

63
00:03:47,060 --> 00:03:44,070

sites on the surface minerals like

64
00:03:50,510 --> 00:03:47,070
silicate oxides and sulfides have a

65
00:03:52,550 --> 00:03:50,520
present on the earlier pyrite is the

66
00:03:56,000 --> 00:03:52,560
most important sulfide mineral on earth

67
00:03:58,820 --> 00:03:56,010
and many chemical do tell chemical and

68
00:04:02,000 --> 00:03:58,830
biological reaction occur on on on its

69
00:04:04,460 --> 00:04:02,010
surface is it is present in many readers

70
00:04:09,620 --> 00:04:04,470
busted do chemical and biogeochemical

71
00:04:13,430 --> 00:04:09,630
processes and in deposit formation this

72
00:04:17,060 --> 00:04:13,440
is my laboratory in my Laura Tory I work

73
00:04:20,320 --> 00:04:17,070
in in this number we have two different

74
00:04:26,810 --> 00:04:20,330
number with ultra-high vacuum conditions

75
00:04:28,550 --> 00:04:26,820
in we in this number I have the cleaning

76
00:04:30,470 --> 00:04:28,560
processes I have

77
00:04:33,350 --> 00:04:30,480
sputtering an annealing to clean the

78
00:04:37,150 --> 00:04:33,360
surface and I have expressed technique

79
00:04:40,250 --> 00:04:37,160
and the other number I have lit lit is

80
00:04:43,850 --> 00:04:40,260
low-energy electron diffraction an STM a

81
00:04:45,710 --> 00:04:43,860
scanning tunneling microscopy and why I

82
00:04:48,110 --> 00:04:45,720
need ultra-high vacuum conditions

83
00:04:50,570 --> 00:04:48,120
because with this condition I get a

84
00:04:53,300 --> 00:04:50,580
clean condition and in depth control of

85
00:04:56,330 --> 00:04:53,310
the experimental parameters and my

86
00:04:59,090 --> 00:04:56,340
techniques record ultra-high bekhoon we

87
00:05:01,460 --> 00:04:59,100
told a high bekhoon alums us to study

88
00:05:06,050 --> 00:05:01,470

the atomic level and it is possible the

89
00:05:11,270 --> 00:05:06,060
study of monolayers in this experiment I

90
00:05:13,670 --> 00:05:11,280
have you seen XPS XPS is a x-ray

91
00:05:16,430 --> 00:05:13,680
photoelectron spectroscopy and it's a

92
00:05:18,650 --> 00:05:16,440
surface characterization technique with

93
00:05:20,960 --> 00:05:18,660
this technique I can get information

94
00:05:22,730 --> 00:05:20,970
about elemental composition chemical

95
00:05:24,680 --> 00:05:22,740
state electronic structure and the

96
00:05:29,570 --> 00:05:24,690
sticky AMA tree of the sample and rest

97
00:05:31,909 --> 00:05:29,580
study here you can see the overview XPS

98
00:05:35,180 --> 00:05:31,919
spectra of the pilot mineral single

99
00:05:38,390 --> 00:05:35,190
crystal and we can observe the different

100
00:05:41,659 --> 00:05:38,400
regions of the polite the I don't ray on

101
00:05:44,510 --> 00:05:41,669
the oxygen rayon and the sulfur rayon

102
00:05:46,880 --> 00:05:44,520
and there are out here pics too but in

103
00:05:53,450 --> 00:05:46,890
my experiment I yesterday only the XPS

104
00:05:56,300 --> 00:05:53,460
epics so the summary of a objective are

105
00:05:59,120 --> 00:05:56,310
to understand how amino acids internet

106
00:06:02,360 --> 00:05:59,130
on surfaces to evaluate the role of the

107
00:06:05,840 --> 00:06:02,370
surface to demonstrated that survey is

108
00:06:08,120 --> 00:06:05,850
more relative embedded catalyst and to a

109
00:06:10,909 --> 00:06:08,130
study of restoration of amino acids on

110
00:06:12,710 --> 00:06:10,919
surfaces by innovative and complementary

111
00:06:19,400 --> 00:06:12,720
surface techniques in the astrobiology

112
00:06:21,560 --> 00:06:19,410
file will about the result with

113
00:06:24,650 --> 00:06:21,570

experience I can study the different

114
00:06:27,710 --> 00:06:24,660
regions of the amino acids and on the

115
00:06:30,790 --> 00:06:27,720
surface in my amino acid I have carbon

116
00:06:34,610 --> 00:06:30,800
oxygen neutran a neutron rayon and

117
00:06:36,980 --> 00:06:34,620
impolite I have sulfa ray I'm going to

118
00:06:39,260 --> 00:06:36,990
start with the carbon rayon in this as

119
00:06:41,959 --> 00:06:39,270
like you cannot serve the XPS for the

120
00:06:44,929 --> 00:06:41,969
emission spectra of carbon 1 s Korolev

121
00:06:48,129 --> 00:06:44,939
pics of fisting absorbacron gasps fuzzy

122
00:06:51,850 --> 00:06:48,139
on the gold copper and Paris or faces

123
00:06:57,319 --> 00:06:51,860
for the three surfaces two components

124
00:07:00,850 --> 00:06:57,329
observe it the higher binding energy

125
00:07:05,600 --> 00:07:00,860
component is a carboxylate or acid group

126
00:07:09,139 --> 00:07:05,610
the other component is a carbon join two

127
00:07:14,929 --> 00:07:09,149
amino group and carbon join to digital

128
00:07:16,639 --> 00:07:14,939
fight breathe in the oxygen trailer we

129
00:07:22,219 --> 00:07:16,649
can observe some difference between the

130
00:07:25,189 --> 00:07:22,229
metals and the mineral surfaces in engl

131
00:07:27,259 --> 00:07:25,199
surface and copper surface we can

132
00:07:30,229 --> 00:07:27,269
observe only one component this

133
00:07:33,199 --> 00:07:30,239
component is carboxylate group the as

134
00:07:36,889 --> 00:07:33,209
the group is dis protonate on copper

135
00:07:39,679 --> 00:07:36,899
angle and on pilot we kind of set to

136
00:07:42,379 --> 00:07:39,689
component the carboxylate group and the

137
00:07:45,769 --> 00:07:42,389
acid group and this the other component

138
00:07:51,350 --> 00:07:45,779

is the component of natural pirate but

139
00:07:54,259 --> 00:07:51,360
is not oxygen and there in about the

140
00:07:58,040 --> 00:07:54,269
nutrient rayon we observe difference

141
00:08:01,479 --> 00:07:58,050
between the between the surfaces when

142
00:08:05,600 --> 00:08:01,489
the amino acids also absorb it on the

143
00:08:09,439 --> 00:08:05,610
gold surface we have only one component

144
00:08:13,100 --> 00:08:09,449
and its amino protonate amino group one

145
00:08:17,749 --> 00:08:13,110
the amino acid on a sir is observing on

146
00:08:20,899 --> 00:08:17,759
a copper surface they we have only one

147
00:08:23,239 --> 00:08:20,909
component and is amino group and on

148
00:08:28,269 --> 00:08:23,249
pilot we kind of serve both components

149
00:08:34,459 --> 00:08:28,279
amino group and return eight amino group

150
00:08:37,759 --> 00:08:34,469
and about the super raya on paralyzer on

151
00:08:40,800 --> 00:08:37,769
polite surveys we have two component to

152
00:08:44,940 --> 00:08:40,810
the main component is the

153
00:08:47,130 --> 00:08:44,950
d certified iron of the natural pirate

154
00:08:50,490 --> 00:08:47,140
and the other component is polysulfides

155
00:08:53,790 --> 00:08:50,500
present in the natural pirate and on

156
00:08:58,530 --> 00:08:53,800
copper and gold a surface I I have

157
00:09:02,930 --> 00:08:58,540
similar spectra XPS Petra and we I have

158
00:09:07,440 --> 00:09:02,940
two components this component is a

159
00:09:09,870 --> 00:09:07,450
chorus chorus chorus to this is to metal

160
00:09:12,180 --> 00:09:09,880
this will fight metal component and this

161
00:09:14,579 --> 00:09:12,190
component indicate that the molecule is

162
00:09:17,670 --> 00:09:14,589
interacting on the surface through a

163
00:09:20,570 --> 00:09:17,680

digital fight breed and the other

164
00:09:23,460 --> 00:09:20,580
component is a distal fight breed and

165
00:09:27,690 --> 00:09:23,470
this component niquette the molecule is

166
00:09:32,810 --> 00:09:27,700
not breaking when when when he starts

167
00:09:36,150 --> 00:09:32,820
orbit on the surface okay here we have a

168
00:09:41,400 --> 00:09:36,160
summary of the binding energy of the

169
00:09:46,020 --> 00:09:41,410
different layers carbon rayon oxyanion

170
00:09:47,700 --> 00:09:46,030
and III andreia and oxygen 1s a nutrient

171
00:09:51,240 --> 00:09:47,710
one is rayon present the most

172
00:09:54,360 --> 00:09:51,250
significant difference with oxygen an

173
00:09:57,300 --> 00:09:54,370
entry and rayon I can know about the

174
00:10:01,140 --> 00:09:57,310
chemical thought of the molecule a for

175
00:10:03,660 --> 00:10:01,150
example I know my amino acid on all the

176
00:10:05,850 --> 00:10:03,670
chemical for is Sweetie trionic because

177
00:10:09,780 --> 00:10:05,860
i have carboxylate and a free tonight

178
00:10:14,070 --> 00:10:09,790
amino group on copper the chemical for

179
00:10:16,410 --> 00:10:14,080
of the amino acids is onion because i

180
00:10:21,390 --> 00:10:16,420
observe the carboxylate and the amino

181
00:10:23,910 --> 00:10:21,400
group and on pirate we observed to a

182
00:10:27,210 --> 00:10:23,920
chemical forms onion and carry on

183
00:10:30,090 --> 00:10:27,220
because we have a carboxylate and acid

184
00:10:34,260 --> 00:10:30,100
group and amino were mini loop and

185
00:10:37,490 --> 00:10:34,270
protonate amino group so the conclusions

186
00:10:40,350 --> 00:10:37,500
are fistina molecule has been

187
00:10:42,990 --> 00:10:40,360
successfully a Soviet on gold copper and

188
00:10:45,120 --> 00:10:43,000

pilot there is three possible

189
00:10:47,970 --> 00:10:45,130
interaction point of the molecule on the

190
00:10:50,370 --> 00:10:47,980
surface this will vibrate carboxylate

191
00:10:53,610 --> 00:10:50,380
group and amino protonate amino group

192
00:10:55,410 --> 00:10:53,620
and chemical firm of the molecular

193
00:10:58,410 --> 00:10:55,420
with depends of the reactivity of the

194
00:11:01,230 --> 00:10:58,420
surface I'm polite is more activity than

195
00:11:03,870 --> 00:11:01,240
copper and gold and gold because I'm

196
00:11:08,610 --> 00:11:03,880
pyrite I cannot serve two different

197
00:11:13,110 --> 00:11:08,620
chemical for Cathy on sorry onion and

198
00:11:16,579 --> 00:11:13,120
cartoon while on copper an own goal I

199
00:11:19,850 --> 00:11:16,589
officer only one chemical for on wall is

200
00:11:22,500 --> 00:11:19,860
sweeter young and on copper in sunny on

201
00:11:25,470 --> 00:11:22,510
their four pilot could be a good

202
00:11:28,829 --> 00:11:25,480
candidate to absorb it amino acid and to

203
00:11:43,890 --> 00:11:28,839
facilitate it the pet I formation thank

204
00:11:47,040 --> 00:11:43,900
you very much hi I was wondering whether

205
00:11:50,610 --> 00:11:47,050
you believe that the disulfide bond

206
00:11:53,700 --> 00:11:50,620
formation whether that's catalyzed by

207
00:11:57,090 --> 00:11:53,710
the surface metal through a specific

208
00:12:00,329 --> 00:11:57,100
chemical interaction or whether it might

209
00:12:06,030 --> 00:12:00,339
just be from a decrease in the number of

210
00:12:10,199 --> 00:12:06,040
degrees of diffusional freedom maybe the

211
00:12:15,570 --> 00:12:10,209
mineral or the surface has a catalytic

212
00:12:18,900 --> 00:12:15,580
site and when the the mineral or the

213
00:12:26,870 --> 00:12:18,910

metal are sort of amino acid this amino

214
00:12:44,250 --> 00:12:26,880
acid cool cool I get a two for a protein

215
00:12:50,080 --> 00:12:47,560
just clarify all these reactions are

216
00:12:52,150 --> 00:12:50,090
happening in the gaseous phase not mean

217
00:12:53,950 --> 00:12:52,160
a sore neck sent in the gaseous phase

218
00:12:59,470 --> 00:12:53,960
and then they were dropped on the

219
00:13:06,370 --> 00:12:59,480
mineral surface okay and I I did I have

220
00:13:09,760 --> 00:13:06,380
done different study okay in my in my in

221
00:13:13,510 --> 00:13:09,770
my laboratory I study this Parliament

222
00:13:16,900 --> 00:13:13,520
from solution and flown kasbah see in

223
00:13:19,840 --> 00:13:16,910
this talk i am going i i i i speak about

224
00:13:22,690 --> 00:13:19,850
the from solution and for this

225
00:13:26,290 --> 00:13:22,700
experiment i have I speciale transfer

226
00:13:29,590 --> 00:13:26,300
and I put my molecular and I hate in and

227
00:13:33,010 --> 00:13:29,600
I am a parade the molecule inside of the

228
00:13:36,670 --> 00:13:33,020
chamber and when I this Parliament from

229
00:13:38,950 --> 00:13:36,680
solution I take my suit faces and I put

230
00:13:41,950 --> 00:13:38,960
the surfaces in a solution of the amino

231
00:13:45,910 --> 00:13:41,960
acid with milli-q water and then I

232
00:13:47,500 --> 00:13:45,920
transferred to the number and I use the

233
00:13:51,760 --> 00:13:47,510
different techniques to do a compilation

234
00:13:55,630 --> 00:13:51,770
see read both gas and water for all

235
00:13:58,750 --> 00:13:55,640
three minerals sorry you did gasps and

236
00:14:02,280 --> 00:13:58,760
the solution experiments for all three

237
00:14:07,450 --> 00:14:02,290
minerals gold copper and pyrite no I'm

238
00:14:12,010 --> 00:14:07,460

yeah I am i working at from solution on

239
00:14:16,300 --> 00:14:12,020
gold okay umpire right by the different

240
00:14:19,300 --> 00:14:16,310
is or when when is from solution is not

241
00:14:21,820 --> 00:14:19,310
necessary single crystal is poly crystal

242
00:14:24,760 --> 00:14:21,830
Martine Andhra hi vicuna need single

243
00:14:27,670 --> 00:14:24,770
crystal because with this technically an

244
00:14:30,190 --> 00:14:27,680
STM I need a crystallographic structure

245
00:14:33,040 --> 00:14:30,200
all right finally what was the rationale

246
00:14:35,590 --> 00:14:33,050
behind using d three surfaces gold

247
00:14:38,680 --> 00:14:35,600
copper and pyrite sorry what was the

248
00:14:42,220 --> 00:14:38,690
rationale and why why these three solid

249
00:14:47,110 --> 00:14:42,230
surfaces okay i start with metals

250
00:14:47,940 --> 00:14:47,120
because metals are inert they are ideal

251
00:14:51,630 --> 00:14:47,950
condition

252
00:14:53,460 --> 00:14:51,640
and I want to compare it with a pie

253
00:14:56,240 --> 00:14:53,470
right because i am working in

254
00:15:00,510 --> 00:14:56,250
astrobiology center and we try to

255
00:15:03,390 --> 00:15:00,520
explain the minerals like possible

256
00:15:07,080 --> 00:15:03,400
catalyze there are some theories bernal

257
00:15:09,030 --> 00:15:07,090
and i don't remember the name jaron all