
AbSciCon
2019

1
00:00:00,790 --> 00:00:07,320
[Music]

2
00:00:12,120 --> 00:00:09,080
[Applause]

3
00:00:18,090 --> 00:00:12,130
thank you everyone for stayin at the

4
00:00:19,620 --> 00:00:18,100
last stock and as Michelle said I'm

5
00:00:21,450 --> 00:00:19,630
going to talk about the policy quick

6
00:00:25,200 --> 00:00:21,460
aromatic hydrocarbons and the meaner

7
00:00:27,960 --> 00:00:25,210
interaction so what is catalysis

8
00:00:30,930 --> 00:00:27,970
catalysis is the process of lowering the

9
00:00:33,720 --> 00:00:30,940
warrior of a chemical reaction by adding

10
00:00:35,970 --> 00:00:33,730
something called catalyst this catalyst

11
00:00:40,290 --> 00:00:35,980
brings together two elements in such a

12
00:00:43,340 --> 00:00:40,300
way that they can the reaction is

13
00:00:46,260 --> 00:00:43,350

maximized on the surface of the catalyst

14
00:00:48,270 --> 00:00:46,270
this has been suggested before that is

15
00:00:50,910 --> 00:00:48,280
happening in the space by golden

16
00:00:54,299 --> 00:00:50,920
Saboteur in 1963 where they talk about

17
00:00:56,220 --> 00:00:54,309
the formation of molecular molecular

18
00:00:58,830 --> 00:00:56,230
hydrogen on the surface of dust

19
00:01:01,979 --> 00:00:58,840
particles so this is important because

20
00:01:05,060 --> 00:01:01,989
it suggests that in the absence of any

21
00:01:10,320 --> 00:01:05,070
energy source you can produce more

22
00:01:14,460 --> 00:01:10,330
complex or bigger molecules and our

23
00:01:17,130 --> 00:01:14,470
approach is in the laboratory so what we

24
00:01:20,130 --> 00:01:17,140
did was purchase the her explode

25
00:01:23,280 --> 00:01:20,140
temperature reaction chamber this setup

26
00:01:26,010 --> 00:01:23,290
is used for pharmaceutical purposes but

27
00:01:29,899 --> 00:01:26,020
we modified it so we can use it for

28
00:01:33,300 --> 00:01:29,909
Astrophysics and currently we can call

29
00:01:37,230 --> 00:01:33,310
pressure of 10 to the minus 7 for those

30
00:01:40,140 --> 00:01:37,240
who work with hydrogen setups you know

31
00:01:42,749 --> 00:01:40,150
that is not that good but bear with me

32
00:01:47,840 --> 00:01:42,759
and we can control the temperature

33
00:01:51,030 --> 00:01:47,850
inside our chamber and also we can

34
00:01:55,649 --> 00:01:51,040
irradiate our samples so here is where

35
00:02:01,319 --> 00:01:55,659
we mix our powder samples and is where

36
00:02:04,020 --> 00:02:01,329
we can study in situ using infrared here

37
00:02:06,389 --> 00:02:04,030
this is a this is a thermocouple where

38
00:02:08,850 --> 00:02:06,399

we can study the temperature variations

39
00:02:14,100 --> 00:02:08,860
inside the chamber we have some gas

40
00:02:16,949 --> 00:02:14,110
inlets where we pump the chamber we have

41
00:02:20,640 --> 00:02:16,959
a deal where we can deposit liquid

42
00:02:22,680 --> 00:02:20,650
nitrogen we could cool down our sample

43
00:02:25,979 --> 00:02:22,690
though this is the dome that we use to

44
00:02:28,500 --> 00:02:25,989
seal up our mini chamber and those ports

45
00:02:31,979 --> 00:02:28,510
are for infrared and this one is for

46
00:02:35,180 --> 00:02:31,989
ultraviolet and we have modified this

47
00:02:39,479 --> 00:02:35,190
dome so we can deposit some gases

48
00:02:42,050 --> 00:02:39,489
directly on top of the sample and this

49
00:02:48,569 --> 00:02:42,060
is where we attach our ultra violet lamp

50
00:02:52,350 --> 00:02:48,579
so our goal is to work as realistic as

51
00:02:56,369 --> 00:02:52,360
possible and for that we want to study

52
00:02:58,830 --> 00:02:56,379
some composition of meteorites or cosmic

53
00:03:01,380 --> 00:02:58,840
dust but as you may know there is no

54
00:03:04,800 --> 00:03:01,390
such thing as just one material

55
00:03:07,680 --> 00:03:04,810
composition is a full range of different

56
00:03:10,949 --> 00:03:07,690
elements and for because of that it

57
00:03:13,559 --> 00:03:10,959
makes this story really difficult so we

58
00:03:16,770 --> 00:03:13,569
start with the simple things we will

59
00:03:20,309 --> 00:03:16,780
start with titanium dioxide alumina

60
00:03:22,619 --> 00:03:20,319
oxide and we are building our set up to

61
00:03:28,289 --> 00:03:22,629
more complex things like olive enzyme

62
00:03:31,530 --> 00:03:28,299
pyroxenes so our this subject of a study

63
00:03:34,440 --> 00:03:31,540

is PAHs mostly because they are tough

64
00:03:38,159 --> 00:03:34,450
they can survive space like conditions

65
00:03:40,740 --> 00:03:38,169
so and it's the same we want to build

66
00:03:44,430 --> 00:03:40,750
ourselves up to more complex things so

67
00:03:47,369 --> 00:03:44,440
we first start with simple molecules

68
00:03:53,360 --> 00:03:47,379
like anthracene then some quarantine and

69
00:03:56,640 --> 00:03:53,370
or like IBA so we have done some

70
00:04:00,869 --> 00:03:56,650
experiments with quarantine and Italian

71
00:04:05,699 --> 00:04:00,879
dioxide so we treat the titanium dioxide

72
00:04:07,949 --> 00:04:05,709
for possible contaminations then we mix

73
00:04:12,599 --> 00:04:07,959
it up with quarantine we put inside our

74
00:04:16,170 --> 00:04:12,609
chamber seal it pump it and wait for a

75
00:04:21,409 --> 00:04:16,180
day to have a good vacuum but what we

76
00:04:24,930 --> 00:04:21,419
found out first this is the spectrum of

77
00:04:28,439 --> 00:04:24,940
quarantine with caviar caviar is an

78
00:04:30,420 --> 00:04:28,449
infrared transparent compound so you can

79
00:04:33,060 --> 00:04:30,430
see the nice inspectors of quarantine

80
00:04:33,839 --> 00:04:33,070
and as when you mix it with titanium

81
00:04:36,540 --> 00:04:33,849
dioxide

82
00:04:44,010 --> 00:04:36,550
you see this huge absorption of the

83
00:04:47,189 --> 00:04:44,020
titanium dioxide so we let our sample to

84
00:04:50,909 --> 00:04:47,199
rest for one day inside the chamber what

85
00:04:55,080 --> 00:04:50,919
we found was that something was going on

86
00:04:57,149 --> 00:04:55,090
this is the difference spectrum of Conan

87
00:05:00,149 --> 00:04:57,159
and titanium dioxide which means that

88
00:05:02,640 --> 00:05:00,159

the deposition was obstructed from one

89
00:05:05,879 --> 00:05:02,650
hour two hours three hours and so on so

90
00:05:08,580 --> 00:05:05,889
what we are looking at here is someone's

91
00:05:11,129 --> 00:05:08,590
growing and these bands are aliphatics

92
00:05:14,909 --> 00:05:11,139
these bands are the a symmetric ch2 and

93
00:05:17,869 --> 00:05:14,919
asymmetric ch2 so what is going on we're

94
00:05:21,240 --> 00:05:17,879
having hydrogenation of the PAHs and

95
00:05:25,529 --> 00:05:21,250
something that I didn't say is this is

96
00:05:30,649 --> 00:05:25,539
this was made at room temperature vacuum

97
00:05:35,939 --> 00:05:30,659
conditions no radiation and no

98
00:05:37,589 --> 00:05:35,949
temperature apply so it's by itself so

99
00:05:38,309 --> 00:05:37,599
but what is going on if you have a

100
00:05:43,170 --> 00:05:38,319
vacuum

101
00:05:45,019 --> 00:05:43,180
how original in these PAHs so as I told

102
00:05:47,939 --> 00:05:45,029
you the vacuum is not the best and

103
00:05:51,360 --> 00:05:47,949
people who can work with a high bagging

104
00:05:54,180 --> 00:05:51,370
setup they know that from atmospheric

105
00:05:56,760 --> 00:05:54,190
pressure to 10 to minus 3 so you are

106
00:05:59,790 --> 00:05:56,770
pumping out the earth from your chamber

107
00:06:02,700 --> 00:05:59,800
and from the 23-3 to 22 in mother's

108
00:06:04,890 --> 00:06:02,710
night you are in the drying region where

109
00:06:08,550 --> 00:06:04,900
the pressure inside the chamber is

110
00:06:11,399 --> 00:06:08,560
driven by the water inside the chamber

111
00:06:14,939 --> 00:06:11,409
and this water is stick to the walls of

112
00:06:17,159 --> 00:06:14,949
the chamber so we have water inside and

113
00:06:20,640 --> 00:06:17,169

this water is reaching the titanium

114
00:06:23,100 --> 00:06:20,650
dioxide value dioxide is extremely good

115
00:06:26,879 --> 00:06:23,110
a catalyzing stuff so what happened in

116
00:06:29,129 --> 00:06:26,889
the surface of this tank dioxide is that

117
00:06:31,950 --> 00:06:29,139
this water is breaking into hydrogen and

118
00:06:34,230 --> 00:06:31,960
a wish so at the end you have a pool of

119
00:06:38,040 --> 00:06:34,240
hydrogen that can react with your sample

120
00:06:44,939 --> 00:06:38,050
and this is well this is what we have at

121
00:06:48,510 --> 00:06:44,949
the end herination of colony so but

122
00:06:51,149 --> 00:06:48,520
we wanted to make sure that that was the

123
00:06:56,010 --> 00:06:51,159
what we were seeing it was education and

124
00:06:58,709 --> 00:06:56,020
not some contamination so using our high

125
00:07:03,260 --> 00:06:58,719
back in setup we deposit hydrogenated

126
00:07:06,390 --> 00:07:03,270
quarantine as a thin film we had these

127
00:07:08,850 --> 00:07:06,400
spectrums here where you can see that

128
00:07:12,450 --> 00:07:08,860
the position of the hydrogenated bands

129
00:07:17,070 --> 00:07:12,460
are pretty much the same the band shape

130
00:07:19,619 --> 00:07:17,080
is pretty much similar but when you

131
00:07:22,439 --> 00:07:19,629
compare team films with powders you see

132
00:07:25,350 --> 00:07:22,449
that the bands are not the same and they

133
00:07:27,420 --> 00:07:25,360
actually have achieved so what is going

134
00:07:31,140 --> 00:07:27,430
on is what we are seeing is actually

135
00:07:34,459 --> 00:07:31,150
hydrogenation or this contamination what

136
00:07:38,670 --> 00:07:34,469
we think is going on we may use of the

137
00:07:41,189 --> 00:07:38,680
NASA Ames PI data base is that these are

138
00:07:45,689 --> 00:07:41,199

the aliphatic bands for hydrogenated

139
00:07:47,579 --> 00:07:45,699
colony so if you had Renee quarantine in

140
00:07:51,749 --> 00:07:47,589
one side but with different

141
00:07:53,249 --> 00:07:51,759
configurations you have different bands

142
00:07:56,879 --> 00:07:53,259
with different positions and different

143
00:07:59,700 --> 00:07:56,889
profiles the same if you had resonate

144
00:08:01,920 --> 00:07:59,710
current in the opposite size with

145
00:08:05,219 --> 00:08:01,930
different configuration and actually

146
00:08:10,439 --> 00:08:05,229
this one gives you just the symmetric

147
00:08:12,420 --> 00:08:10,449
ch2 so in conclusion yes we are having

148
00:08:14,189 --> 00:08:12,430
hydrogenation and is different from the

149
00:08:19,139 --> 00:08:14,199
one that we had in the high back in

150
00:08:21,119 --> 00:08:19,149
setup we have done also some experiments

151
00:08:24,990 --> 00:08:21,129
with anthracene and alumina oxide

152
00:08:27,209 --> 00:08:25,000
because we wanted to to be sure that

153
00:08:34,009 --> 00:08:27,219
everything that was happening was on the

154
00:08:42,180 --> 00:08:37,350
we mix some anthracene with alumina

155
00:08:46,139 --> 00:08:42,190
oxide but this alumina oxide we mix it

156
00:08:50,730 --> 00:08:46,149
with d 2o for a day then the next day we

157
00:08:54,600 --> 00:08:50,740
dry up the alumina oxide but of course

158
00:08:57,300 --> 00:08:54,610
you still have some DTO molecules

159
00:09:01,530 --> 00:08:57,310
attached to the aluminum oxide after do

160
00:09:05,490 --> 00:09:01,540
you dry it up and if we assume in this

161
00:09:09,300 --> 00:09:05,500
region this in red is the spectrum of

162
00:09:11,790 --> 00:09:09,310
the derivative anthracene in aluminum

163
00:09:14,910 --> 00:09:11,800

oxide fully literature Anderson and this

164
00:09:18,600 --> 00:09:14,920
one is the spectrum of regular

165
00:09:20,280 --> 00:09:18,610
anthracene in aluminum oxide and here

166
00:09:22,620 --> 00:09:20,290
you can see the aromatic for regular

167
00:09:26,550 --> 00:09:22,630
antigen and this is the aromatic region

168
00:09:32,330 --> 00:09:26,560
for the fully decorated addressing what

169
00:09:33,990 --> 00:09:32,340
we had is this is the spectrum of

170
00:09:39,000 --> 00:09:34,000
regular anthracene

171
00:09:42,600 --> 00:09:39,010
on aluminum oxide with d2o and this is

172
00:09:45,660 --> 00:09:42,610
the spectrum of undressing fully rated

173
00:09:49,080 --> 00:09:45,670
anthracene in aluminum oxide and if you

174
00:09:52,620 --> 00:09:49,090
wait a day with this experiment of

175
00:09:54,630 --> 00:09:52,630
deuterated anthracene you find out that

176
00:09:58,260 --> 00:09:54,640
under battle conditions anthracene

177
00:10:01,920 --> 00:09:58,270
sublimates so you end up with a ratio

178
00:10:06,680 --> 00:10:01,930
like this here and if we compare that

179
00:10:11,370 --> 00:10:06,690
one to the anthracene on alumina oxide

180
00:10:14,850 --> 00:10:11,380
treated with e - oh you find that we

181
00:10:18,390 --> 00:10:14,860
have this bands perfectly match here so

182
00:10:25,470 --> 00:10:18,400
what we are having is da change of

183
00:10:28,620 --> 00:10:25,480
hydrogen and deuterium in the PHS so as

184
00:10:29,730 --> 00:10:28,630
some conclusions in the absence of an

185
00:10:32,910 --> 00:10:29,740
energy source

186
00:10:35,070 --> 00:10:32,920
no UV no temperature we're having

187
00:10:37,950 --> 00:10:35,080
hydrogenation and we are having

188
00:10:42,570 --> 00:10:37,960

deuterium hydrogen exchange so what is

189
00:10:45,570 --> 00:10:42,580
going on if we put some you either or we

190
00:10:49,800 --> 00:10:45,580
call our sample or we heat it up that's

191
00:10:53,340 --> 00:10:49,810
coming up so we want to thank NASA and

192
00:10:58,060 --> 00:10:53,350
the in Aiken seven for the funding of

193
00:10:58,070 --> 00:11:01,470
[Applause]

194
00:11:14,069 --> 00:11:04,930
we have time for questions maybe two or

195
00:11:21,310 --> 00:11:19,329
yes when you enter the range of ten to

196
00:11:25,120 --> 00:11:21,320
minus 3 10 10 to the minus 9

197
00:11:31,210 --> 00:11:25,130
use your under vacuum conditions but is

198
00:11:35,980 --> 00:11:31,220
not a perfect vacuum so so what what it

199
00:11:40,269 --> 00:11:35,990
means is that you have removed most of

200
00:11:43,540 --> 00:11:40,279
the air that it was inside but some

201
00:11:48,819 --> 00:11:43,550
water was is still stick to the surface

202
00:11:53,410 --> 00:11:48,829
of the chamber and that means the dug

203
00:11:56,019 --> 00:11:53,420
water is affecting well not affecting

204
00:11:58,900 --> 00:11:56,029
you try to remove that water so if you

205
00:12:00,790 --> 00:11:58,910
go lower than 10 to the minus 9 you

206
00:12:03,550 --> 00:12:00,800
enter the hydrogen regime where

207
00:12:06,970 --> 00:12:03,560
molecular hydrogen is the one driven the

208
00:12:10,030 --> 00:12:06,980
driving the pressure inside so is no

209
00:12:12,490 --> 00:12:10,040
more water but it will be hurting so you

210
00:12:21,519 --> 00:12:12,500
are trying to remove hydrogen below 10

211
00:12:25,530 --> 00:12:21,529
to minus 9 and you have a question all