1
00:00:16,950 --> 00:00:14,549
there's a lot to consider when you're

2
00:00:19,269 --> 00:00:16,960
designing mirrors for a space telescope

3
00:00:21,109 --> 00:00:19,279
they need to be lightweight sturdy and

4
00:00:23,590 --> 00:00:21,119
not change shape so much just because

5
00:00:26,630 --> 00:00:23,600
it's a little cold like 400 degrees

6
00:00:29,910 --> 00:00:26,640
below zero glass won't do the trick like

7
00:00:32,630 --> 00:00:29,920
it does here on earth but beryllium will

8
00:00:38,630 --> 00:00:32,640
so where do you find this rare metal

9
00:00:43,270 --> 00:00:40,470
hey so rob where are we going

10
00:00:46,310 --> 00:00:43,280
we're headed to our current active open

11
00:00:47,270 --> 00:00:46,320
pit berlin mine this mine is is the only

12
00:00:49,590 --> 00:00:47,280
mine

13
00:00:51,750 --> 00:00:49,600

like this in the entire world

14
00:00:53,670 --> 00:00:51,760
so these are the only beryllium miners

15
00:00:55,430 --> 00:00:53,680
that you'll find we are currently

16
00:00:58,549 --> 00:00:55,440
standing on

17
00:00:59,910 --> 00:00:58,559
the edge of our active pit

18
00:01:02,310 --> 00:00:59,920
where

19
00:01:04,149 --> 00:01:02,320
the hard rock is being excavated that

20
00:01:06,710 --> 00:01:04,159
covers the

21
00:01:09,109 --> 00:01:06,720
brilliant more so why is beryllium so

22
00:01:12,149 --> 00:01:09,119
valuable it is

23
00:01:13,750 --> 00:01:12,159
very strong and very light it's a third

24
00:01:15,670 --> 00:01:13,760
the weight of aluminum

25
00:01:19,190 --> 00:01:15,680
and has a six times the stiffness of

26
00:01:21,910 --> 00:01:19,200
steel how tough is it to find beryllium

27
00:01:23,910 --> 00:01:21,920
it took us about 30 years to gather

28
00:01:24,710 --> 00:01:23,920
all the data and information

29
00:01:27,429 --> 00:01:24,720
to

30
00:01:30,550 --> 00:01:27,439
design and develop this mine

31
00:01:32,069 --> 00:01:30,560
and once the ore leaves this mine is it

32
00:01:34,149 --> 00:01:32,079
ready for the folks at the james webb

33
00:01:35,749 --> 00:01:34,159
space telescope program to use it to

34
00:01:38,550 --> 00:01:35,759
build the mirrors

35
00:01:41,270 --> 00:01:38,560
no after the ore material leaves the

36
00:01:43,510 --> 00:01:41,280
mine it is shipped to the processing

37
00:01:45,670 --> 00:01:43,520
plant about 50 miles east of here oh

38
00:01:48,069 --> 00:01:45,680

great well thank you so much for

39
00:01:50,870 --> 00:01:48,079
welcoming us and letting us see your

40
00:01:53,910 --> 00:01:50,880
berlin mine you're very welcome so phil

41
00:01:55,990 --> 00:01:53,920
we just came from the beryllium mine and

42
00:01:58,310 --> 00:01:56,000
rob told us that you guys take the ore

43
00:02:00,950 --> 00:01:58,320
that they over there dig up

44
00:02:03,429 --> 00:02:00,960
yes that's right but yours hauled

45
00:02:05,190 --> 00:02:03,439
in and putting up in these pockets here

46
00:02:07,030 --> 00:02:05,200
and then we crush that ore and mix it

47
00:02:09,190 --> 00:02:07,040
with water to start the process all

48
00:02:11,430 --> 00:02:09,200
right so phil we just came from the ore

49
00:02:12,949 --> 00:02:11,440
and you said they crush it and then what

50
00:02:14,710 --> 00:02:12,959
well this is the ore

51
00:02:16,869 --> 00:02:14,720
what we get from the mine

52
00:02:18,710 --> 00:02:16,879
and then we crush to a very fine slurry

53
00:02:20,550 --> 00:02:18,720
and then after we leach it we have the

54
00:02:21,589 --> 00:02:20,560
beryllium in the water

55
00:02:23,750 --> 00:02:21,599
and

56
00:02:25,350 --> 00:02:23,760
the bottom has most of the brilliant

57
00:02:27,750 --> 00:02:25,360
leeched out of it

58
00:02:29,830 --> 00:02:27,760
what's happening here is that the

59
00:02:31,509 --> 00:02:29,840
slurry from the leaching area is brought

60
00:02:33,190 --> 00:02:31,519
out here through a pipeline

61
00:02:35,030 --> 00:02:33,200
and it goes into this well where it's

62
00:02:37,750 --> 00:02:35,040
mixed with a flocculant what's a

63
00:02:39,270 --> 00:02:37,760

flocculent it ties up the fine particles

64
00:02:41,750 --> 00:02:39,280
with a big particle so they will settle

65
00:02:44,470 --> 00:02:41,760
to the bottom okay and then the

66
00:02:47,110 --> 00:02:44,480
clear overflow becomes the solution that

67
00:02:48,630 --> 00:02:47,120
we process to get the beryllium out of

68
00:02:50,710 --> 00:02:48,640
this is the solution that we just came

69
00:02:53,190 --> 00:02:50,720
from those big tanks out there and

70
00:02:55,910 --> 00:02:53,200
that'll be filtered to remove those fine

71
00:02:57,750 --> 00:02:55,920
particles and then we mix that solution

72
00:02:59,750 --> 00:02:57,760
with the organic layer

73
00:03:01,910 --> 00:02:59,760
and the beryllium goes into the organic

74
00:03:03,830 --> 00:03:01,920
layer and most of the impurities stay in

75
00:03:05,350 --> 00:03:03,840
the water layer now you said organic

76
00:03:08,229 --> 00:03:05,360
layer what what does that mean to the

77
00:03:10,470 --> 00:03:08,239
rest of us it's like oil and vinegar

78
00:03:12,229 --> 00:03:10,480
this is the oil in your oil and vinegar

79
00:03:16,550 --> 00:03:12,239
so you're putting oil in or you're

80
00:03:21,750 --> 00:03:19,350
the vinegar would be the water solution

81
00:03:24,309 --> 00:03:21,760
and we have a special extraction in the

82
00:03:26,550 --> 00:03:24,319
oil layer okay so it flows to the top

83
00:03:29,030 --> 00:03:26,560
and we can concentrate and purify the

84
00:03:30,710 --> 00:03:29,040
beryllium

85
00:03:33,350 --> 00:03:30,720
still a liquid here

86
00:03:35,670 --> 00:03:33,360
what then happens we purify it and

87
00:03:38,149 --> 00:03:35,680
precipitate it into a powder which we

88
00:03:39,830 --> 00:03:38,159

then package beryllium dust is not

89
00:03:41,509 --> 00:03:39,840
exactly the best thing to be near but

90
00:03:44,710 --> 00:03:41,519
can we see something that resembles a

91
00:03:47,110 --> 00:03:44,720
powder yes i have some

92
00:03:50,070 --> 00:03:47,120
sodium carbonate

93
00:03:51,190 --> 00:03:50,080
right here which is very similar to the

94
00:03:52,949 --> 00:03:51,200
texture

95
00:03:54,789 --> 00:03:52,959
and the fluffiness of our powder if it

96
00:03:57,110 --> 00:03:54,799
was dry it looks kind of like a talcum

97
00:03:58,309 --> 00:03:57,120
powder really but very much so

98
00:04:00,710 --> 00:03:58,319
these are the drums that we have our

99
00:04:01,830 --> 00:04:00,720
material in ready for shipment and you

100
00:04:04,309 --> 00:04:01,840
said shipment where are they going to go

101
00:04:07,830 --> 00:04:04,319
to next these will probably go to elmore

102
00:04:10,149 --> 00:04:07,840
ohio elmore ohio has what delmar ohio is

103
00:04:12,229 --> 00:04:10,159
the plant brush almanol and converts it

104
00:04:14,630 --> 00:04:12,239
into finished goods so it's going to

105
00:04:18,310 --> 00:04:14,640
come out looking like a metal yes it'll

106
00:04:19,830 --> 00:04:18,320
come out as a metal an alloy or an oxide

107
00:04:21,990 --> 00:04:19,840
well thanks so much for showing us your

108
00:04:25,350 --> 00:04:22,000
plant you're certainly welcome well you

109
00:04:27,670 --> 00:04:25,360
can find beryllium mixed with metals in

110
00:04:29,270 --> 00:04:27,680
everyday life like computers cell phones

111
00:04:31,110 --> 00:04:29,280
and even your car

112
00:04:33,749 --> 00:04:31,120
you can only find pure beryllium in

113
00:04:35,430 --> 00:04:33,759

specialized items like x-ray machines

114
00:04:37,590 --> 00:04:35,440
space satellites and

115
00:04:39,670 --> 00:04:37,600
now the james webb space telescope