

# Concept Generation

Team 314: Abbott Reusable RF Probes

## Concept Generation

The next step in our project was to explore and brainstorm a range of possible concepts within our scope that could be used to solve the problem that our project is taking on. To fulfill our customer's needs, we chose to focus on exploring alternative materials similar to the materials used in the construction of current RF reusable electrodes. The team collaborated to come up with 108 different viable concepts that our project could take on with the help of some concept generation tools.

The primary concept generation tool used was a morphological chart, since we knew what individual components were that could possibly be changed to stay within our scope. Development of the chart was supported by lateral thinking from the team and cross-referencing similar products for differences between Abbott's product and others.

\*Note: these concepts have yet to be subjected to a concept selection process and may not be part of the final device prototype.

## High Fidelity Concepts

The following concepts are the most promising concepts out of our list of 108. The 304 stainless steel, PESU, PCT, and PSU were chosen because of their superior physical properties and availability.

### Concept 1

The first high fidelity concept generated is to make the shaft out of 304 stainless steel, and the hub out of polyethersulfone (PESU).

### Concept 2

The second high fidelity concept generated is to make the shaft out of 304 stainless steel, and the hub out of Polycyclohexylenedimethylene Terephthalate (PCT).

### Concept 3

The third high fidelity concept generated is to make the shaft out of 304 stainless steel, and the hub out of Polysulfone (PSU).

# Medium-Fidelity Concepts

Our concept generation session also yielded several alternative medium-fidelity concepts that are good “runner up” concepts that could make a case for being one of the best solutions. These concepts are based on the use of 304 stainless steel, along with some other alternate materials PAEK, PEI, SPS, PPSU, and PPS.

## Concept 1

The first medium-fidelity concept generated is to make the shaft out of 304 stainless steel, and the hub out of Polyaryletherketones (PAEK).

## Concept 2

The second medium-fidelity concept generated is to make the shaft out of 304 stainless steel, and the hub out of Polyaryletherketones (PEI).

## Concept 3

The third medium-fidelity concept generated is to make the shaft out of 304 stainless steel, and the hub out of Syndiotactic Polystyrene (SPS).

## Concept 4

The fourth medium-fidelity concept generated is to make the shaft out of 304 stainless steel, and the hub out of Syndiotactic Polystyrene (PPSU).

## Concept 5

The fifth medium-fidelity concept generated is to make the shaft out of 304 stainless steel, and the hub out of Polyetherimide (PPS).

## Concept Table (Morphological Chart)

Durability of Materials	
Shaft Material (12)	Hub Material (9)
304 Stainless Steel	Polyethersulfone (PESU)
316 Stainless Steel	Polycyclohexylenedimethylene Terephthalate (PCT)
Tungsten	Polysulfone (PSU)
308 Stainless Steel	Polyaryletherketones (PAEK)
309 Stainless Steel	Polyetherimide (PEI)
310 Stainless Steel	Syndiotactic Polystyrene (SPS)
321 Stainless Steel	Polyphenylsulfone (PPSU)
330 Stainless Steel	Polyphenylene Sulfide (PPS)
403 Stainless Steel	Polyphthalamide (PPA)
420 Stainless Steel	
422 Stainless steel	
442 Stainless Steel	

*Table 1. Morphological table for concept generation*

1. Shaft made of 304 stainless steel; hub made of PAEK.
2. Shaft made of 304 stainless steel; hub made of PESU.
3. Shaft made of 304 stainless steel; hub made of PCT.

4. Shaft made of 304 stainless steel; hub made of PSU.
5. Shaft made of 304 stainless steel; hub made of PEI.
6. Shaft made of 304 stainless steel; hub made of SPS.
7. Shaft made of 304 stainless steel; hub made of PPSU.
8. Shaft made of 304 stainless steel; hub made of PPS.
9. Shaft made of 304 stainless steel; hub made of PPA.
10. Shaft made of 316 Stainless Steel; hub made of PESU.
11. Shaft made of 316 Stainless Steel; hub made of PCT.
12. Shaft made of 316 Stainless Steel; hub made of PSU.
13. Shaft made of 316 Stainless Steel; hub made of PAEK.
14. Shaft made of 316 Stainless Steel; hub made of PEI.
15. Shaft made of 316 Stainless Steel; hub made of SPS.
16. Shaft made of 316 Stainless Steel; hub made of PPSU.
17. Shaft made of 316 Stainless Steel; hub made of PPS.
18. Shaft made of 316 Stainless Steel; hub made of PPA.
19. Shaft made of Tungsten; hub made of PESU.
20. Shaft made of Tungsten; hub made of PCT.
21. Shaft made of Tungsten; hub made of PSU.
22. Shaft made of Tungsten; hub made of PAEK.
23. Shaft made of Tungsten; hub made of PEI.
24. Shaft made of Tungsten; hub made of SPS.
25. Shaft made of Tungsten; hub made of PPSU.

26. Shaft made of Tungsten; hub made of PPS.
27. Shaft made of Tungsten; hub made of PPA.
28. Shaft made of 308 Stainless Steel; hub made of PESU.
29. Shaft made of 308 Stainless Steel; hub made of PCT.
30. Shaft made of 308 Stainless Steel; hub made of PSU.
31. Shaft made of 308 Stainless Steel; hub made of PAEK.
32. Shaft made of 308 Stainless Steel; hub made of PEI.
33. Shaft made of 308 Stainless Steel; hub made of SPS.
34. Shaft made of 308 Stainless Steel; hub made of PPSU.
35. Shaft made of 308 Stainless Steel; hub made of PPS.
36. Shaft made of 308 Stainless Steel; hub made of PPA.
37. Shaft made of 309 Stainless Steel; hub made of PESU.
38. Shaft made of 309 Stainless Steel; hub made of PCT.
39. Shaft made of 309 Stainless Steel; hub made of PSU.
40. Shaft made of 309 Stainless Steel; hub made of PAEK.
41. Shaft made of 309 Stainless Steel; hub made of PEI.
42. Shaft made of 309 Stainless Steel; hub made of SPS.
43. Shaft made of 309 Stainless Steel; hub made of PPSU.
44. Shaft made of 309 Stainless Steel; hub made of PPS.
45. Shaft made of 309 Stainless Steel; hub made of PPA.
46. Shaft made of 310 Stainless Steel; hub made of PESU.
47. Shaft made of 310 Stainless Steel; hub made of PCT.

48. Shaft made of 310 Stainless Steel; hub made of PSU.
49. Shaft made of 310 Stainless Steel; hub made of PAEK.
50. Shaft made of 310 Stainless Steel; hub made of PEI.
51. Shaft made of 310 Stainless Steel; hub made of SPS.
52. Shaft made of 310 Stainless Steel; hub made of PPSU.
53. Shaft made of 310 Stainless Steel; hub made of PPS.
54. Shaft made of 310 Stainless Steel; hub made of PPA.
55. Shaft made of 321 stainless steel; hub made of PESU.
56. Shaft made of 321 stainless steel; hub made of PCT.
57. Shaft made of 321 stainless steel; hub made of PSU.
58. Shaft made of 321 Stainless Steel; hub made of PAEK.
59. Shaft made of 321 Stainless Steel; hub made of PEI.
60. Shaft made of 321 Stainless Steel; hub made of SPS.
61. Shaft made of 321 Stainless Steel; hub made of PPSU.
62. Shaft made of 321 Stainless Steel; hub made of PPS.
63. Shaft made of 321 Stainless Steel; hub made of PPA.
64. Shaft made of 330 Stainless Steel; hub made of PESU.
65. Shaft made of 330 Stainless Steel; hub made of PCT.
66. Shaft made of 330 Stainless Steel; hub made of PSU.
67. Shaft made of 330 Stainless Steel; hub made of PAEK.
68. Shaft made of 330 Stainless Steel; hub made of PEI.
69. Shaft made of 330 Stainless Steel; hub made of SPS.

70. Shaft made of 330 Stainless Steel; hub made of PPSU.
71. Shaft made of 330 Stainless Steel; hub made of PPS.
72. Shaft made of 330 Stainless Steel; hub made of PPA.
73. Shaft made of 403 Stainless Steel; hub made of PESU.
74. Shaft made of 403 Stainless Steel; hub made of PCT.
75. Shaft made of 403 Stainless Steel; hub made of PSU.
76. Shaft made of 403 Stainless Steel; hub made of PAEK.
77. Shaft made of 403 Stainless Steel; hub made of PEI.
78. Shaft made of 403 Stainless Steel; hub made of SPS.
79. Shaft made of 403 Stainless Steel; hub made of PPSU.
80. Shaft made of 403 Stainless Steel; hub made of PPS.
81. Shaft made of 403 Stainless Steel; hub made of PPA.
82. Shaft made of 420 Stainless Steel; hub made of PESU.
83. Shaft made of 420 Stainless Steel; hub made of PCT.
84. Shaft made of 420 Stainless Steel; hub made of PSU.
85. Shaft made of 420 Stainless Steel; hub made of PAEK.
86. Shaft made of 420 Stainless Steel; hub made of PEI.
87. Shaft made of 420 Stainless Steel; hub made of SPS.
88. Shaft made of 420 Stainless Steel; hub made of PPSU.
89. Shaft made of 420 Stainless Steel; hub made of PPS.
90. Shaft made of 420 Stainless Steel; hub made of PPA.
91. Shaft made of 422 Stainless steel; hub made of PESU.

92. Shaft made of 422 Stainless steel; hub made of PCT.
93. Shaft made of 422 Stainless steel; hub made of PSU.
94. Shaft made of 422 Stainless steel; hub made of PAEK.
95. Shaft made of 422 Stainless steel; hub made of PEI.
96. Shaft made of 422 Stainless steel; hub made of SPS.
97. Shaft made of 422 Stainless steel; hub made of PPSU.
98. Shaft made of 422 Stainless steel; hub made of PPS.
99. Shaft made of 422 Stainless steel; hub made of PPA.
100. Shaft made of 422 Stainless steel; hub made of PESU.
101. Shaft made of 442 Stainless Steel; hub made of PCT.
102. Shaft made of 442 Stainless Steel; hub made of PSU.
103. Shaft made of 442 Stainless Steel; hub made of PAEK.
104. Shaft made of 442 Stainless Steel; hub made of PEI.
105. Shaft made of 442 Stainless Steel; hub made of SPS.
106. Shaft made of 442 Stainless Steel; hub made of PPSU.
107. Shaft made of 442 Stainless Steel; hub made of PPS.
108. Shaft made of 442 Stainless Steel; hub made of PPA.