Material Selection

1. Translation

Function – What does the component do?

- Prevents user from spilling his mug
- Being cleaned in a dishwasher
- Being in contact with liquid
- Can withstand hot drinks

Constraints – What non-negotiable conditions must be met?

- Cannot absorb liquid
- Withstand temperatures of hot and cold drinks
- Dishwasher-proof
- A low thermal conductivity
- Stiff enough
- Strong enough
- Resist corrosion

For mass production:

- Possible to make a lot in a short time

Objective – What is to be maximized or minimized?

- Minimize the amount of drink that can be spilled

Free variables – What parameters of the problem is the designer free to change?

- Choice of Material

2. Screening

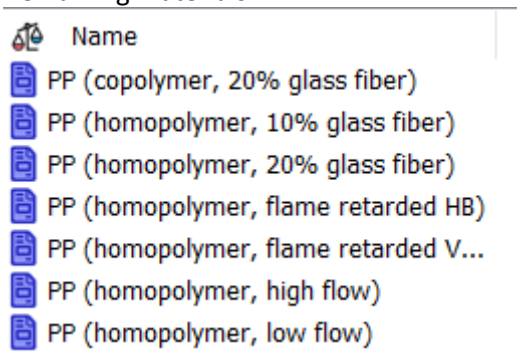
Translate Design Requirements to material properties:

Cannot absorb liquid	-> Bulk material, density <641
Withstand temperatures of hot and cold drinks	-> service temperature between -18 – 100 C
Dishwasher-proof	-> excellent use for liquids between 4-10 ph
Withstand all drinks	-> “
Resist corrosion	-> “
Stiff enough	-> young’s modulus 1,5 GPa
Strong enough	-> tensile strength 20 MPa
Suitable for mass production	-> injection moulding
A low thermal conductivity	-> filter list on thermal conductivity

3. Ranking

After a strict screening of materials, there are seven materials left that are suitable for the product.

Remaining materials:



Filtered on thermal conductivity:

Name	Thermal conductivity (W/...
PP (homopolymer, flame retarded V...	0,127 - 0,132
PP (homopolymer, 10% glass fiber)	0,186 - 0,193
PP (homopolymer, low flow)	0,205 - 0,213
PP (homopolymer, high flow)	0,205 - 0,214
PP (homopolymer, flame retarded HB)	0,225 - 0,234
PP (copolymer, 20% glass fiber)	0,261 - 0,271
PP (homopolymer, 20% glass fiber)	0,284 - 0,295

4. Documentation

Filtered on the lowest thermal conductivity the first three materials will be explored.
First of all PP (homopolymer, flame retarded V-0). This material has a lot of typical uses. Such as furniture and electronic applications, but also a lot of uses that can hold food or drinks such as bowls, bottles and caps. The maximum service temperature is 103 C. price is €1,88 - €2,17
Then PP (homopolymer, 10% glass fiber). The typical uses of this material are almost the same as the first material that was discussed. It is even more extensive with typical uses as sports goods. The yield strength is higher (36,2-46,2 MPa) and also the maximum service temperature goes up to 120 degrees C. This material is also cheaper (€1,57 - €1,77). One disadvantage is that unlike the first material this material is not recyclable.
The third material is PP (homopolymer, low flow). This is used for even more things and especially for food and drinks. The yield strength is a bit lower than the second material (32,9-36,4 MPa) the maximum service temperature is 124 degrees. This material is even cheaper: €1,- - €1,20. Also is this material recyclable. In the table, there can be seen that PP (homopolymer, high flow) is ranked in the 4th place, but has almost the same thermal conductivity. Besides that this material is almost the same as PP (homopolymer, low flow).

5. Conclusion

Since PP (homopolymer, low flow). Perfectly meets the requirements of the material that is needed. It has a lot of typical uses for food and drinks and has the lowest price. It is also recyclable which makes it perfect for mass production. That is why PP (homopolymer, low flow) is the chosen material.

https://waarzitwatin.nl/producten/broodtrommels-drinkbekers