Deliverable C: Design Criteria and Target Specification

GNG 1103

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1. Introduction

Canadian Nuclear Laboratories explores various aspects of nuclear science and technology in Canada. They study a variety of materials to help improve design features, however using new material comes with uncertainty and potential challenges. The goal of the device we make is to test various materials and produce replicable scientific data on a given erosion parameter in a short time. This report discusses design criteria, technical benchmarking and target specification of the project.

2. List of Prioritised Design Criteria

From the client meeting, we were able to synthesise needs statements. These needs statements were then prioritised and translated into design criteria in the table proceeding.

Priority #	Need Statement	Design Criteria
1	The device is low risk to its users.	Ambient Atmospheric Conditions
		Use of Dangerous Fluid
		RPM
		Noise Level
2	The device is able to accelerate the erosion of a variety of materials.	Container's Size
		Loadability
3	The device is able to produce results after a short run-time.	Time Required for Results
4	The device is able to simulate at least one isolated factor causing erosion without increasing the speed of material.	(saved for after the 1st draft)
5	Within the parameters that are being tested, the device is able to be adjusted to test with the different measurable intensities of these parameters.	Number of Controllable Parameters
6	The material used for the device is durable enough to withstand the erosion testing from its internal processes.	Durability
		Type of Built Material(s)
7	The material used for the device is accessible and inexpensive.	Affordability
8	The device is portable.	Size
		Weight
9	The device is aesthetically pleasing.	Outer Design

3. Technical Benchmarking

Specifications	N, Ojala et al Study of Erosion [1]	LPR Global Korea SEW190 [2]	LPR Global Korea SEW190D [2]
RPM	**1000-2000**	**2000-3000**	**400**
Sample Size	4/6x3 mm, 6x3/8 mm and 8/10 mm	30 mm x 5 mm x 2 mm	25 mm x 76 mm x 12.7 mm
Sample Orientation Angle	N/A	15°, 30°, 45°, 60°,75°, 90°	N/A
Abrasive	Granite Gravel	SiC, Al2O3, SiO2 powder, Sand	SiC, Al2O3, SiO2 powder, Sand
Data Collecting Instruments	Data Record and Computer	Data Record and Save	Graphic Display, Data Record and Save
Ability to Test Multiple Samples	Yes	Yes	Yes
Chamber Height	300 mm	N/A	N/A
Chamber Diameter	273mm	N/A	N/A

4. Target Specifications

Minimum size	25 cm x 25cm x 25cm
Maximum weight (dry)	10kg
Rotating speed (constant)	100 rpm to 1000 rpm
Maximum fluid temperature	30°C
Maximum size of abrasives (diameter)	0.01mm
Maximum pressure of the system	1 atm (not pressurized)
Data collecting instruments	Thermometer, stop watch, display (optional)
Ability to test more than one material	Yes

5. Client Meeting Reflection

Meeting the client provided clarity for how we would design the product. Before the client meeting professor Knox informed us that our projects were going to involve the production of a device that accelerated erosion; this was the only information we were given prior. Given that no one in the group had worked with a device similar to this, we started off by benchmarking. This process was very broad and we looked into a variety of accelerated erosion testing devices since we were not sure what the client wanted to use the device for and what conditions the device would be operating in. From our benchmarking we saw that there was a range of different options that we could explore with regards to erosion parameters–from increased pressure to increase in rotational speed to increase in viscosity– and since we were given so little information, we were not able to narrow down these parameters into a more plausible range. Upon meeting the client, she described what specifically the product would be used for and the current product that they have been working with; she explained that they were looking for different parameters to test for erosion since the current parameters were not producing results indicative of real-life use. This meeting helped in the creation of a user needs statement, which subsequently aided the development of design criteria. For example, since the liaison from CNL said that there was little they could do about the speed of the material/part they were testing in terms of increasing the speed, we knew that although speed is an important parameter to explore in accelerated erosion, we had to explore other aspects. Overall, the meeting was very helpful in determining the direction of the project.

6. Conclusion

The product we make will explore multiple parameters of erosion while taking into account the client needs and target specification discussed in this report. The technical benchmarking and the client's needs guided the metrics we outlined. Ideally the final product would be able to integrate all aspects of the specifications and all the needs statements. We will begin making up prototype designs in the next step of the design process: ideate.

Trello Link: https://trello.com/c/jcDj7dZr

7. References

[1] N, Ojala, et al. "Effect of Test Parameters on Large Particle High Speed Slurry Erosion Testing."*Taylor & Francis Group*, vol. 8, 2014, pp. 98-104, https://www.tandfonline.com/doi/full/10.1179/1751584X14Y.0000000066.

[2] “Slurry Erosion Wear Test System SEW190.” LPR Global and US KoreaHotlink, Korea https://www.uskoreahotlink.com/