

PhD notebook

Hugo REYMOND

Contents

| | |
|---|----------|
| 1 Administration | 2 |
| 2 Teaching | 2 |
| 2.1 Course preparation | 2 |
| 3 Bibliography | 2 |
| 3.1 Powder production processes | 2 |
| 3.1.1 Gas atomization | 2 |
| 3.1.2 Water atomization | 2 |
| 3.1.3 Centrifugal atomization | 2 |
| 3.1.4 Plasma atomization | 2 |
| 3.1.5 Mechanical attrition and alloying | 2 |
| 3.1.6 Melt spinning | 2 |
| 3.1.7 Rotating electrode process (REP) | 2 |
| 3.1.8 Chemical processes | 2 |
| 3.2 Factors influencing metallic powder size and quality during gas atomization | 2 |
| 3.2.1 Feedstock melting | 2 |
| 3.2.2 Gaz environment | 3 |
| 3.2.3 Nozzle geometry | 3 |
| 3.2.4 Thermal condition | 3 |
| 3.3 Powder characterization | 3 |
| 3.3.1 Ductility and hardness | 3 |
| 3.3.2 Impurities and reactivity | 3 |
| 3.3.3 Tap density, apparent density, compressibility, green strength, flow properties and compressibility | 3 |
| 4 Experiment: title | 3 |
| 4.1 Description | 3 |
| 4.2 Tools / method / protocol | 3 |
| 4.3 Results | 3 |
| 4.4 Discussion | 3 |
| 4.5 Next steps | 3 |
| TO-DO LIST | 3 |

1 Administration

- Create tax card, need contract information as salary
 - ⇒ link is here and go to Forskudsopgørelse
- Webinar "moving to Denmark and PhD at DTU"
 - ⇒ take the session 2026/02/20 from 1pm to 2 pm
- Mandaroty introduction culture day
 - ⇒ Chose the option 10 March from 10:45 am to 2 pm
- Introduction to responsible conduct of research and research data management for new employees
 - ⇒ chose 6 April from 9am to 1 pm

2 Teaching

2.1 Course preparation

3 Bibliography

3.1 Powder production processes

3.1.1 Gas atomization

3.1.2 Water atomization

3.1.3 Centrifugal atomization

3.1.4 Plasma atomization

3.1.5 Mechanical attrition and alloying

3.1.6 Melt spinning

3.1.7 Rotating electrode process (REP)

3.1.8 Chemical processes

3.2 Factors influencing metallic powder size and quality during gas atomization

3.2.1 Feedstock melting

One of the melting process is to use a crucible heated by induction. It allows different type of feedstock as powder, scrap, wire, and can accept pure metal elements or pre-alloyed elements. All these parameters will impact the powder quality. For instance, the melted scraps can be heterogeneous and can come with oxidation and impurities. In these cases, it is recommended to take a sample of the homogenous melted material in order to analyze the chemistry [1].

Both opened and closed melting systems are used in gas atomization. When the metal is molten in open air, the risk of oxidation and contamination is increased, even if the slag brings a natural protection that is very commonly used in pyro-metallurgical processes [2].

3.2.2 Gaz environment

3.2.3 Nozzle geometry

3.2.4 Thermal condition

3.3 Powder characterization

3.3.1 Ductility and hardness

3.3.2 Impurities and reactivity

3.3.3 Tap density, apparent density, compressibility, green strength, flow properties and compressibility

4 Experiment: title

4.1 Description

4.2 Tools / method / protocol

4.3 Results

4.4 Discussion

4.5 Next steps

TO-DO LIST

| | |
|--|---|
| ➢ Create tax card, need contract information as salary | 2 |
| ➢ Webinar "moving to Denmark and PhD at DTU | 2 |
| ➢ Mandaroty introduction culture day | 2 |
| ➢ Introduction to responsible conduct of research and research data management for new employees | 2 |

References

- [1] Kazybek Kassym and Asma Perveen. Atomization processes of metal powders for 3D printing. *Materials Today: Proceedings*, 26:1727–1733, 2020.
- [2] Holappa and Kaçar. Slag Formation — Thermodynamic and Kinetic Aspects and Mechanisms. *Advances in Molten Slags, Fluxes, and Salts: Proceedings of the 10th International Conference on Molten Slags, Fluxes and Salts 2016*, 2016.