



# Material Sciences Review

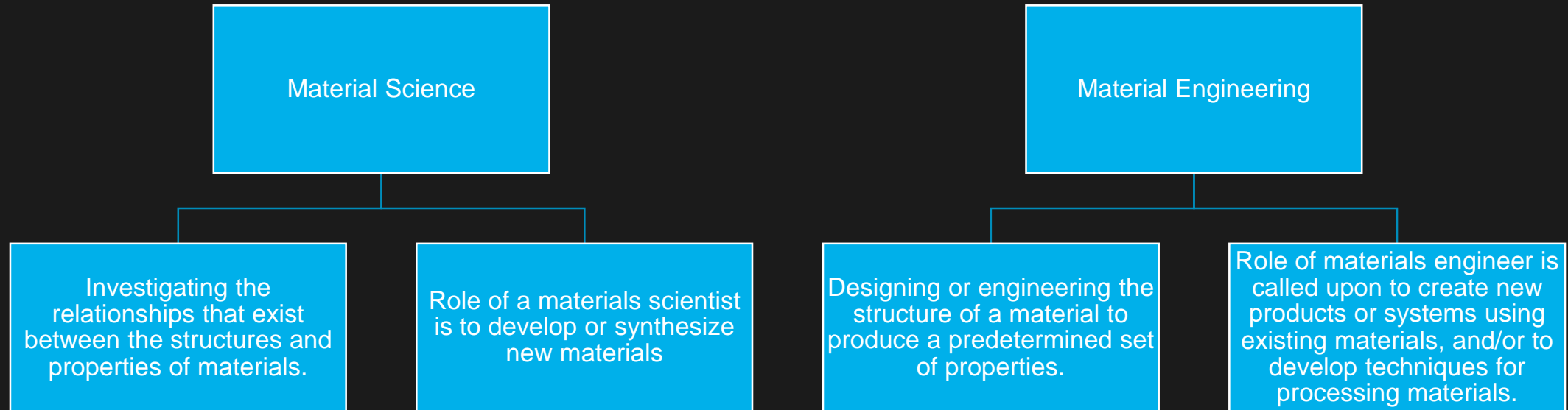
Amardeep Singh Sidhu | Epoch Zero | Generating Knowledge Bases From Scientific Publications

# References/ Credit

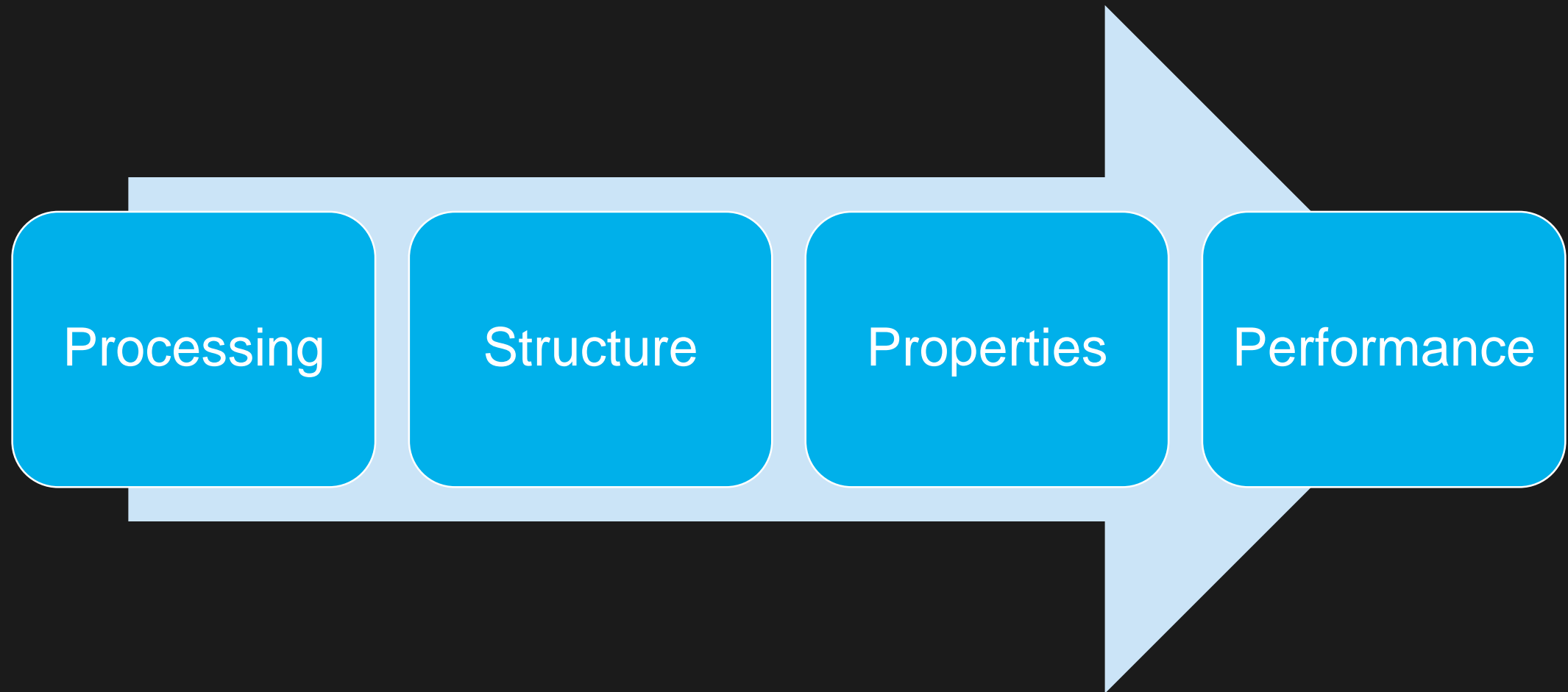
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- Material Science and Engineering an Introduction by William Callister & David Rethwisch.
- Alan Asper Guzik , NeurIPS 2019.

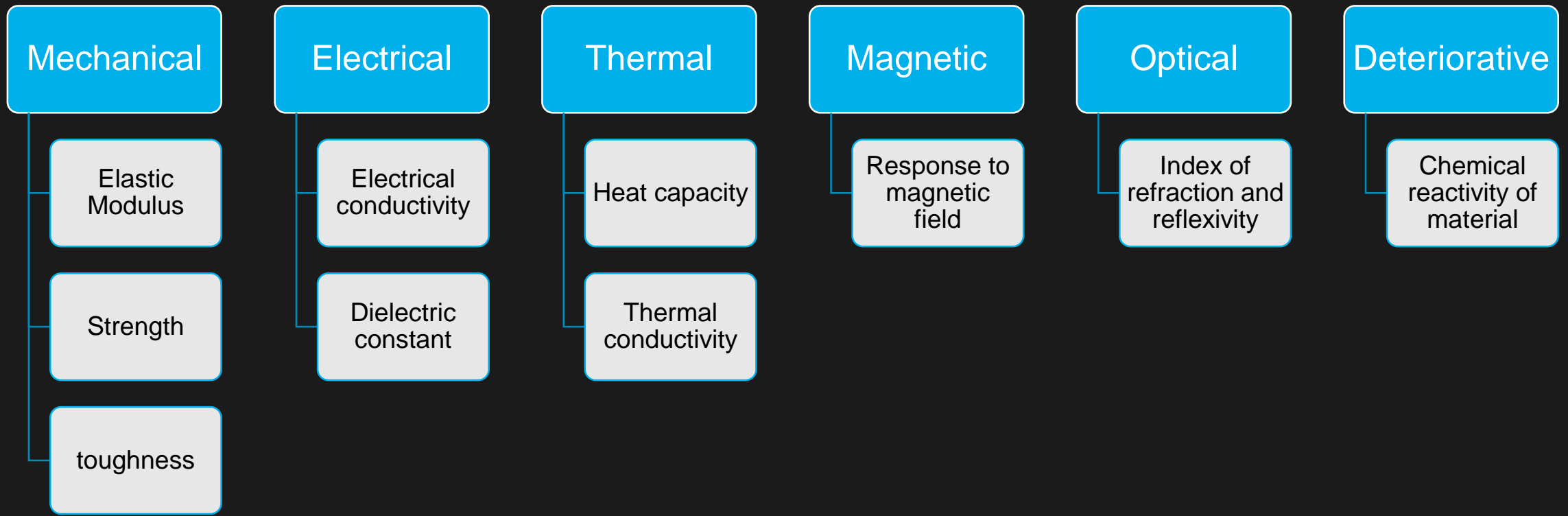
# Material Science and Engineering



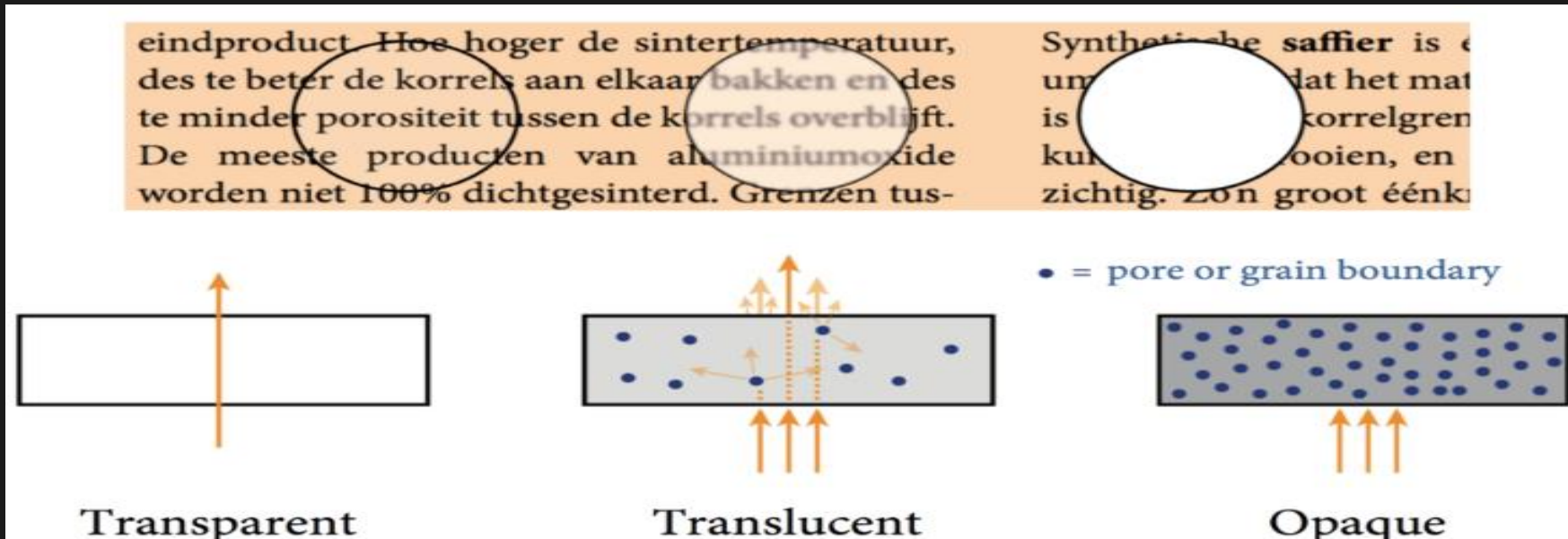
# Relationship between components of material science



# Properties of materials



# Example of inter relation of components of material science



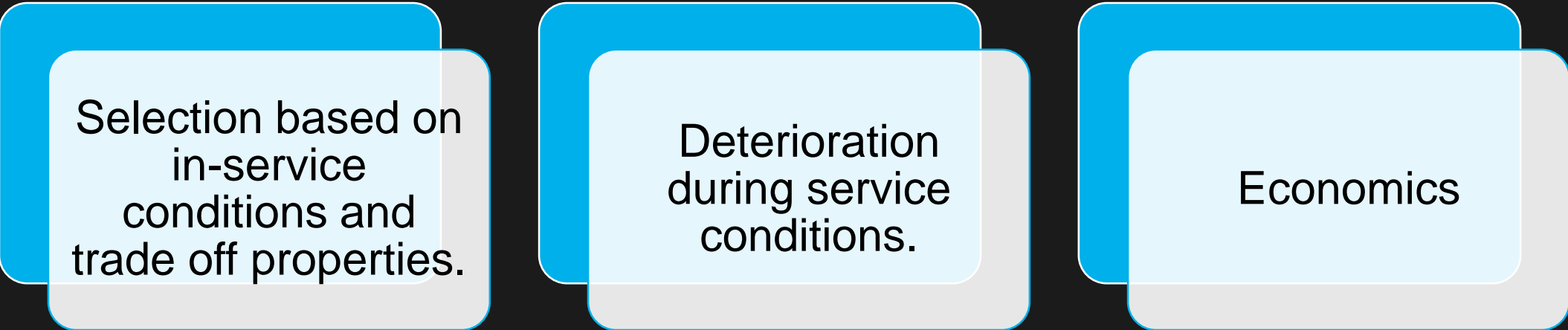
Source:

<http://www.betase.nl/advancedceramics/light-transmission-of-aluminium-oxide/?lang=en>

<https://hackaday.com/2018/04/03/whats-the-deal-with-transparent-aluminum/>

The ceramic material aluminium oxide, also known as alumina, is completely opaque, translucent or transparent – depending on the structure, and therefore on the manufacturing process

# 3 Criteria for Selection of Material



Selection based on  
in-service  
conditions and  
trade off properties.

Deterioration  
during service  
conditions.

Economics

# Classification of materials



## Metals

Metallic elements with non metallic elements in relatively small amount.

Stiff, strong, ductile, good conductor of heat and electricity.

Fe, Co & Ni have magnetic properties.



## Ceramics

Between Metallic and Non Metallic ( such as Oxides , Nitrites & Carbides)

Traditional ceramics – clay , porcelain and glass.

Stiff, strong, hard, insulative to heat and electricity & resistant to high temperature



## Polymer

Plastic and rubber materials. Many are organic compounds based on carbon, hydrogen etc.

Large molecular structure.



## Composites

Wood and bone are naturally occurring composites.

Fiberglass and Carbon fiber reinforced polymer



## Advance Materials

Semiconductor

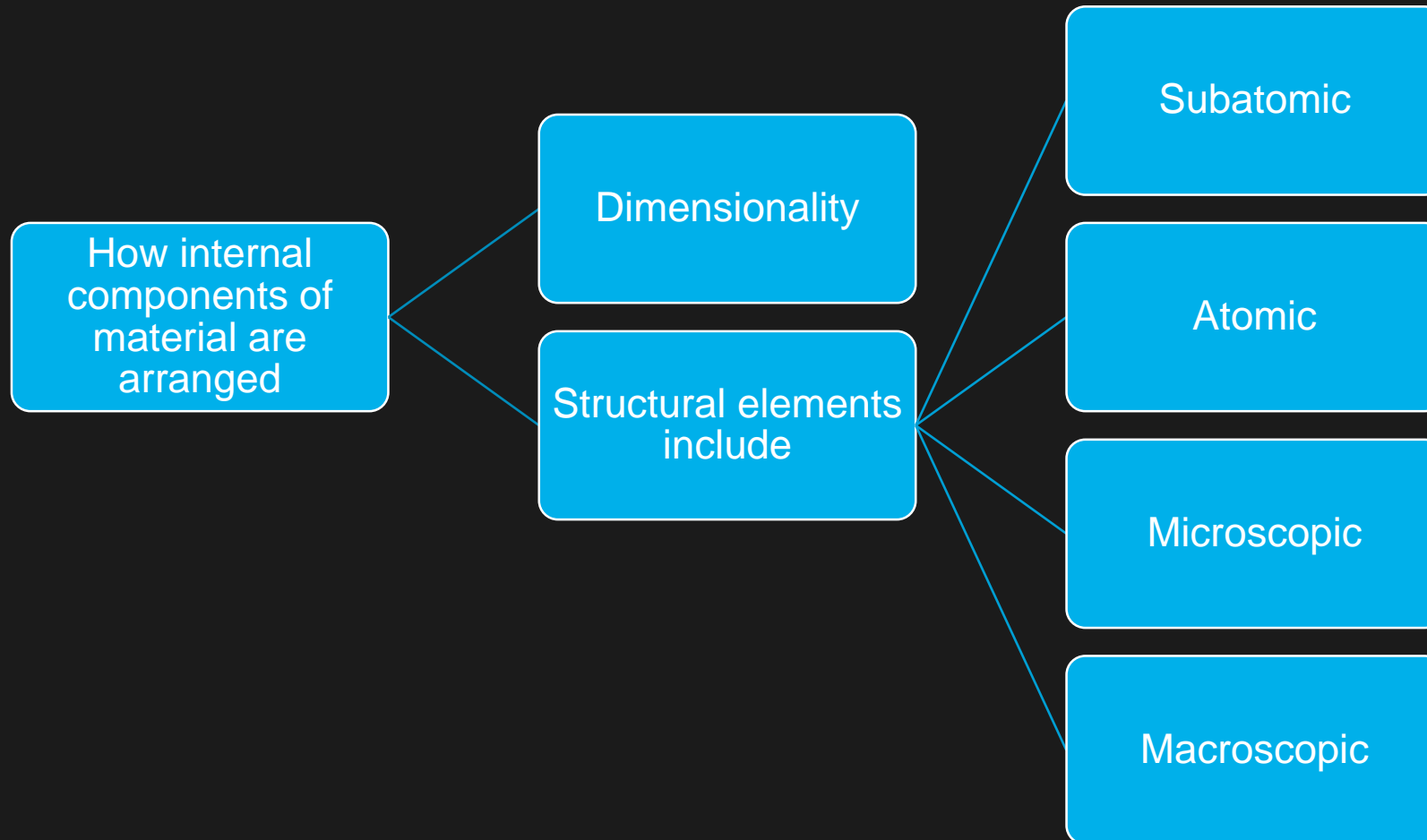
Bio Material

Smart Material

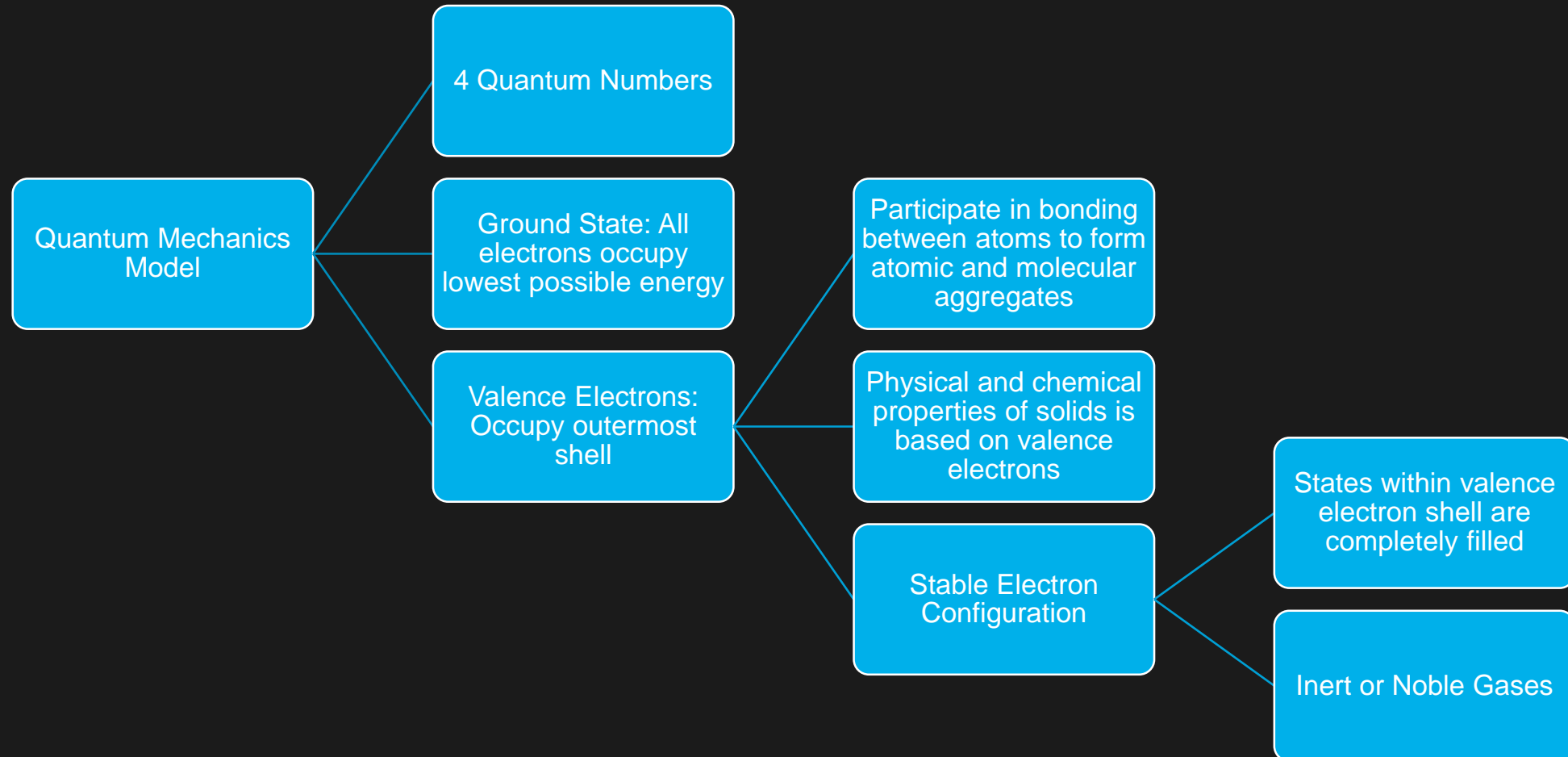
Nano Material



# Our Objective: Find relationship between Structure Properties



# Our Objective: Find relationship between Atomic Structure Properties



# Periodic Table

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**Figure 2.6** The periodic table of the elements. The numbers in parentheses are the atomic weights of the most stable or common isotopes.

- Most Elements come under Metal / Electropositive elements.
  - Capable of giving up few valence electrons to become positively charged.
- Elements on right side of periodic table are electronegative elements.

# Variables

## Controlled variables

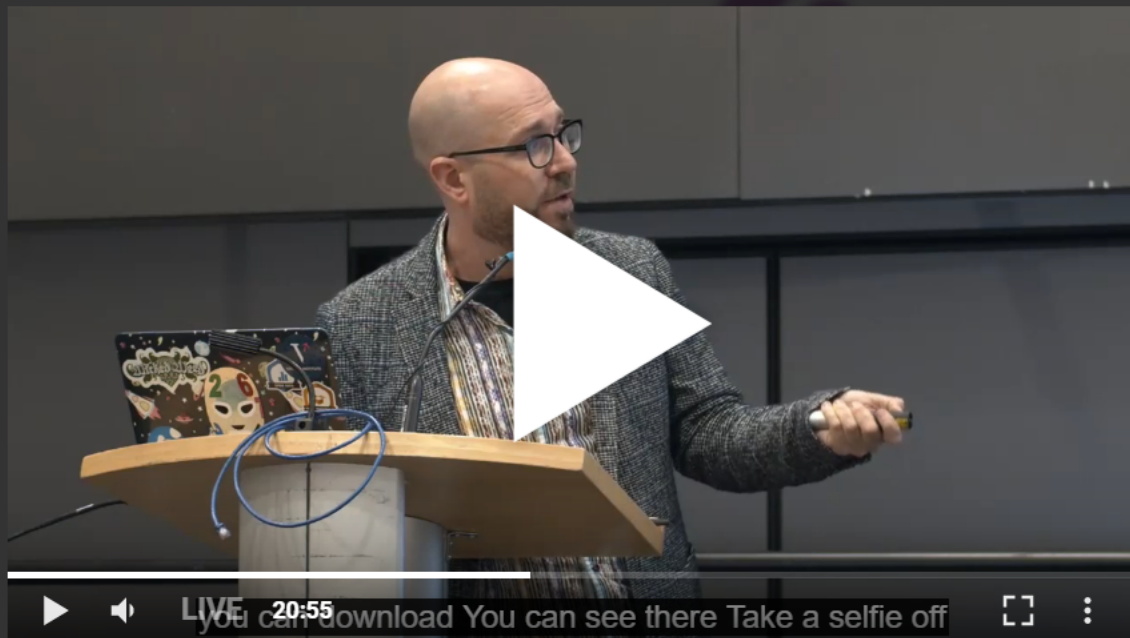
- These are kept the same throughout your experiments

## Independent variable

- The **one** variable you purposely change and test

## Dependent variable

- The measure of change observed because of independent variable
- Decide how you will measure the change



**MAP elements**

1. Closing the loop
2. AI for Materials
3. Modular Materials Robotics
4. Inverse Design
5. Bridging Length and Timescales
6. Data Infrastructure and Exchange

**Learn more about MAPs**



Aspuru-Guzik and Persson  
<https://bit.ly/2BJ81Vv>

Tabor, et al., Nature Reviews  
Materials 3, 5–20 (2018)

Sanchez-Lengeling and Aspuru-Guzik,  
Science 361, 360 (2018)

Häse, Roch, and Aspuru-Guzik  
Trends in Chemistry 1, 282 (2019)



# LatinX in AI (LAI) Affinity Workshop 6

by **Alan Aspuru Guzik** · Dec 9, 2019 · 7 views · **NeurIPS**

✉ [Leave us a message](#)

Add your answer / solution here

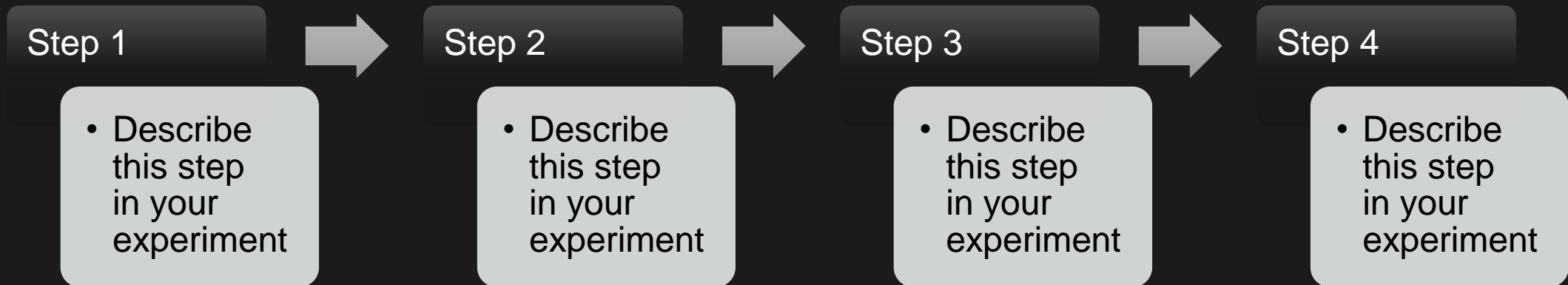
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Hypothesis

# Materials

[illegible]

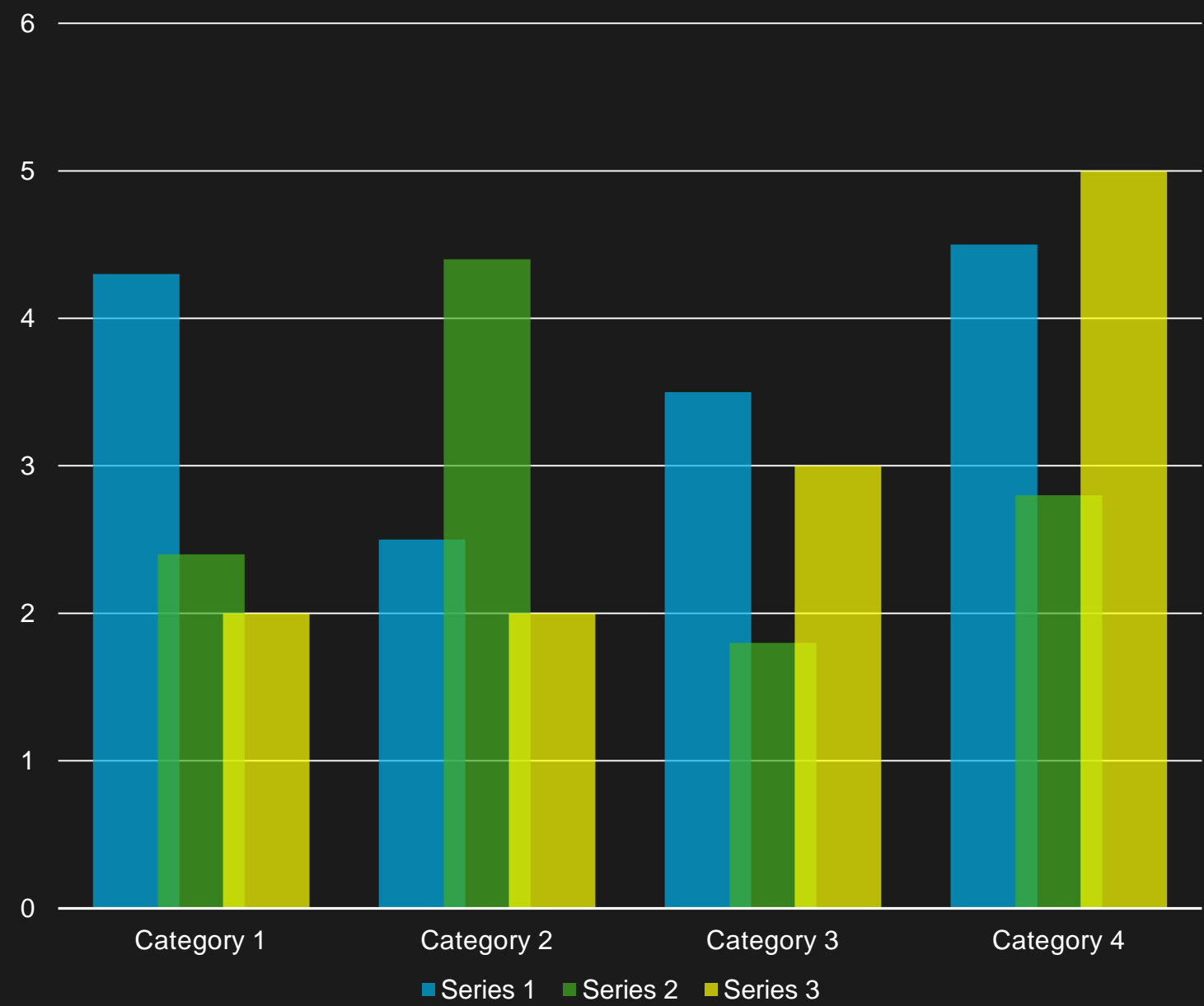
# Procedure





# Data/Observations

Include Observation based on the data from your experiments



# Conclusion

---

- Brief summary of what you discovered based on results
- Indicate and explain whether or not the data supports your hypothesis

# Works Cited

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- Include print and electronic sources in alphabetical order