

## Title: Critical Raw Materials for Future Propulsion Systems

### Problem statement

Decarbonization of civil air mobility is enabled by new kinds of propulsion concepts. These propulsion systems need non-fossil based energy storage and highly efficient conversion systems. The current key material challenges of kerosene combustion engines like high temperature resistance is shifted to new functionalities. For example, ion conductivity in fuel cells (SOFC), resistance free super conductivity of high power systems (Airbus ASCEND) or ultra-high electrical resistance at high temperature in motor winding insulations. It is expected that these functionalities can only be addressed by ceramic based materials.

However, the high functional ceramics are based on critical raw materials like raw earths element, Yttria, Scandium and others. These raw earth elements generate a heavy ecological footprint and are strongly controlled by non-EU suppliers (such as China and Russia). The future propulsion systems are therefore directly linked to the supply chain of these materials which is influenced by economic, social and governmental aspects.

### Research question(s)

How to reduce ecological impact of the critical raw materials supply chain? How to mitigate risks in these supply chains? Are these impacts and risks dependent on the on the future application and material type/quantity?

### Expected type of work

1. Research on new propulsion systems which need critical raw materials -> summary of function / requirements and potential material types/compositions and quantity (literature study, industrial interviews, ...)
2. Assessment of criticality with respect to ESG risks (LCA, supply chain analysis)
3. Elaborate mitigation actions based on the 5 R's (refuse, reduce, ...recycle) depending on the material type and quantity incl. assessment of risks, challenges and benefits of the new solutions (e.g. recycling of SiC ceramics -> costs, material degradation, etc.)



### References

- Critical Raw Materials for Strategic Technologies and Sectors in the EU, 2021  
[https://rmis.jrc.ec.europa.eu/uploads/CRMs\\_for\\_Strategic\\_Technologies\\_and\\_Sectors\\_in\\_the\\_EU\\_2020.pdf](https://rmis.jrc.ec.europa.eu/uploads/CRMs_for_Strategic_Technologies_and_Sectors_in_the_EU_2020.pdf)

### Commissioner details

Organization / Department: Airbus

Name: Christian Metzner

Email: [christian.metzner@airbus.com](mailto:christian.metzner@airbus.com)