



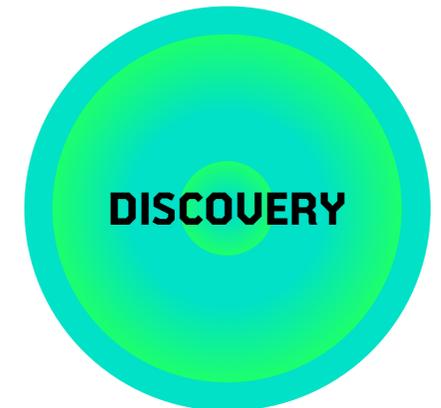
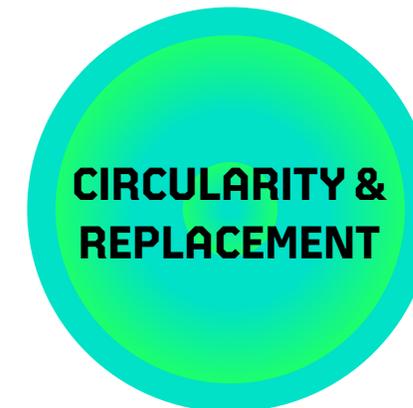
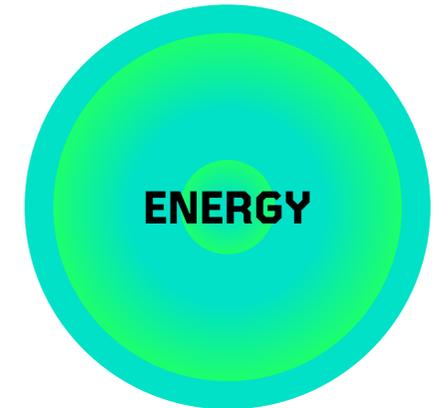
Wallenberg Initiative
Materials Science
for Sustainability

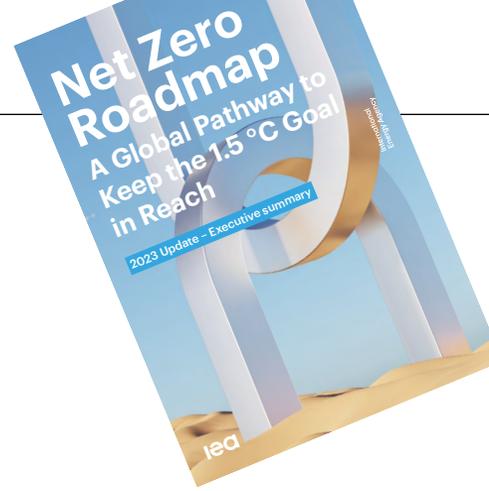
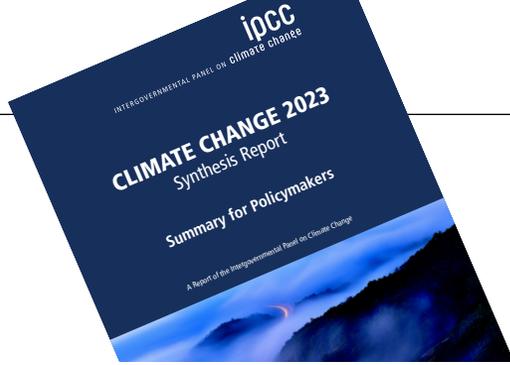
Materials science
that enables a
sustainable world

A sustainable future through materials science

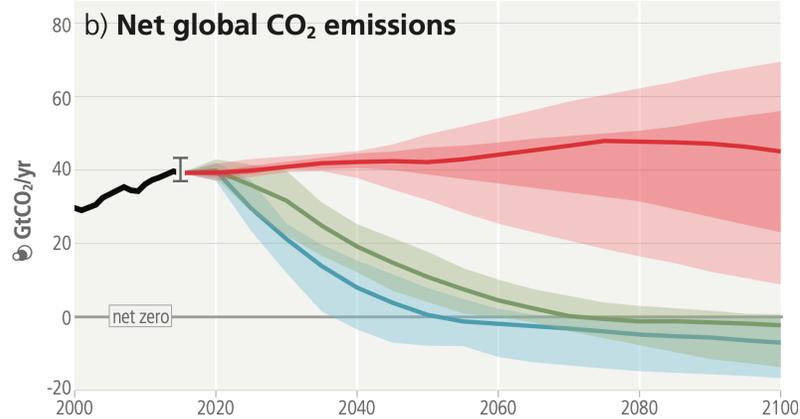
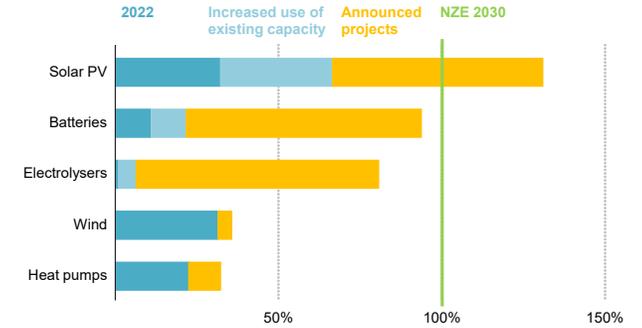
The Wallenberg Initiative Materials Science for Sustainability (WISE), is a Swedish research program initiated and financed by the Knut and Alice Wallenberg Foundation.

- M€ 270 spanning 2022–2033
- Strategic recruitment of 28 asst/assoc professors
- International guest professor program
- 186 PhD students and 186 postdocs
- Graduate school
- Research and technology platforms
- Research arenas with Swedish industry

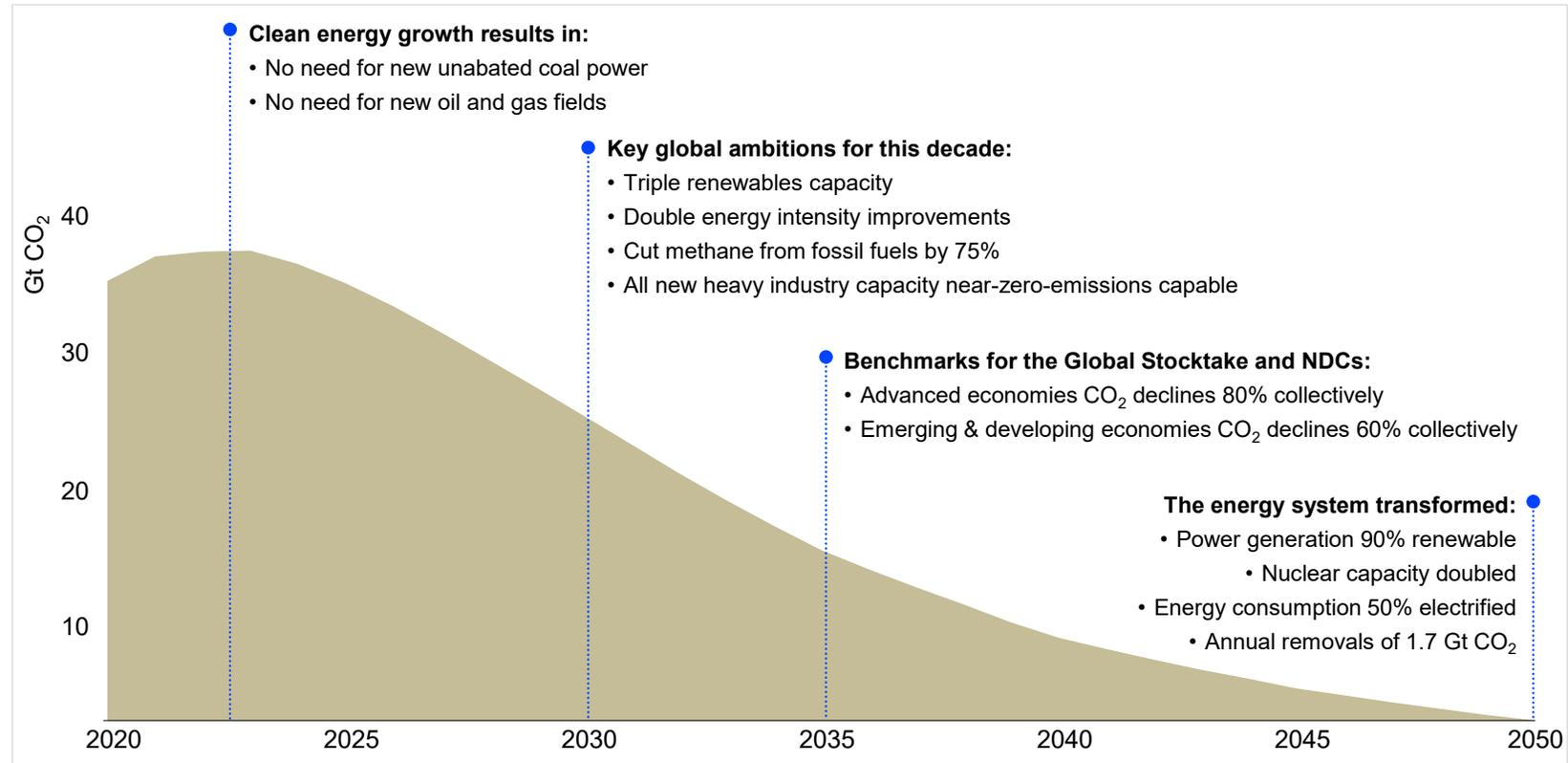
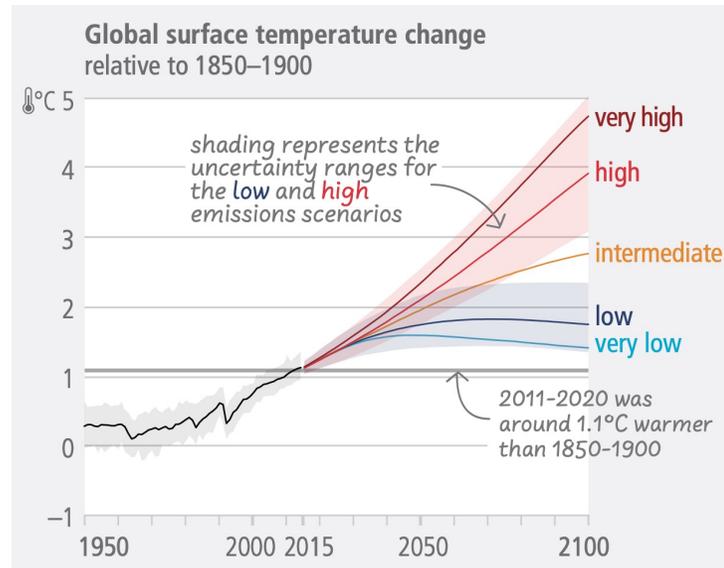




Announced manufacturing project throughput and deployment of key technologies in the NZE Scenario



A roadmap to net zero by 2050



Global Risks Report 2024



FIGURE C

Global risks ranked by severity over the short and long term

"Please estimate the likely impact (severity) of the following risks over a 2-year and 10-year period."

Risk categories

- Economic
- Environmental
- Geopolitical
- Societal
- Technological

2 years



Source

World Economic Forum Global Risks Perception Survey 2023-2024.

The **Global Risks Perception Survey (GRPS)** has underpinned the *Global Risks Report* for nearly two decades and is the World Economic Forum's premier source of original global risks data. This year's GRPS has brought together leading insights on the evolving global risks landscape from 1,490 experts across academia, business, government, the international community and civil society. Responses for the GRPS 2023-2024 were collected from 4 September to 9 October 2023.

COP28, Dubai 30 Nov to 13 Dec 2023

– Results, Key Findings and Summary

- Establishment of a **loss and damage fund for the most vulnerable countries**. This was agreed on during the first days of the COP.
- Agreements on mitigation measures now include **a fossil fuel phase out (instead of only a phase down)** to achieve net-zero emissions by 2050.
- The private sector will be supported by the launch of **\$30 billion private market climate capital**.
- A lot of challenges and criticism occurred in Dubai, many of them facing towards its **exporting country**.



Wopke Hoekstra
European Union Commissioner for Climate Action



This COP will mark the beginning of the end of fossil fuels. The text we have in front of us sets in motion an irreversible, and accelerated transition away from fossil fuels. Humanity has finally done what is long, long, long overdue.

Innovation and Intellectual Property in Sweden

Global Innovation Index 2023
Innovation in the face of uncertainty

GII rank	Economy	Score	Income group rank	Region rank
1	Switzerland	67.6	1	1
2	Sweden	64.2	2	2
3	United States	63.5	3	1
4	United Kingdom	62.4	4	3
5	Singapore	61.5	5	1
6	Finland	61.2	6	4
7	Netherlands (Kingdom of the)	60.4	7	5
8	Germany	58.8	8	6



Global Innovation Tracker Dashboard

Science and innovation investment	Scientific publications	R&D investments	Venture capital deal numbers	Venture capital deal values	International patent filings
Technological progress	Computing power	Costs of renewable energy	Electric battery price	Cost of genome sequencing	Drug approvals
Technology adoption	Safe sanitation	Connectivity	Robots	Electric vehicles	Cancer radiotherapy
Socioeconomic impact	Labor productivity	Life expectancy	Carbon dioxide emissions		

World Corporate Top R&D Investors:
**PAVING THE WAY FOR
CLIMATE NEUTRALITY**



“20% of climate-related patents have a digital component
- *Compared to 33% for patents across all technological fields*”

*“green-tech” patents refers to climate change mitigation or adaptation patents



Wallenberg Initiative
Materials Science
for Sustainability

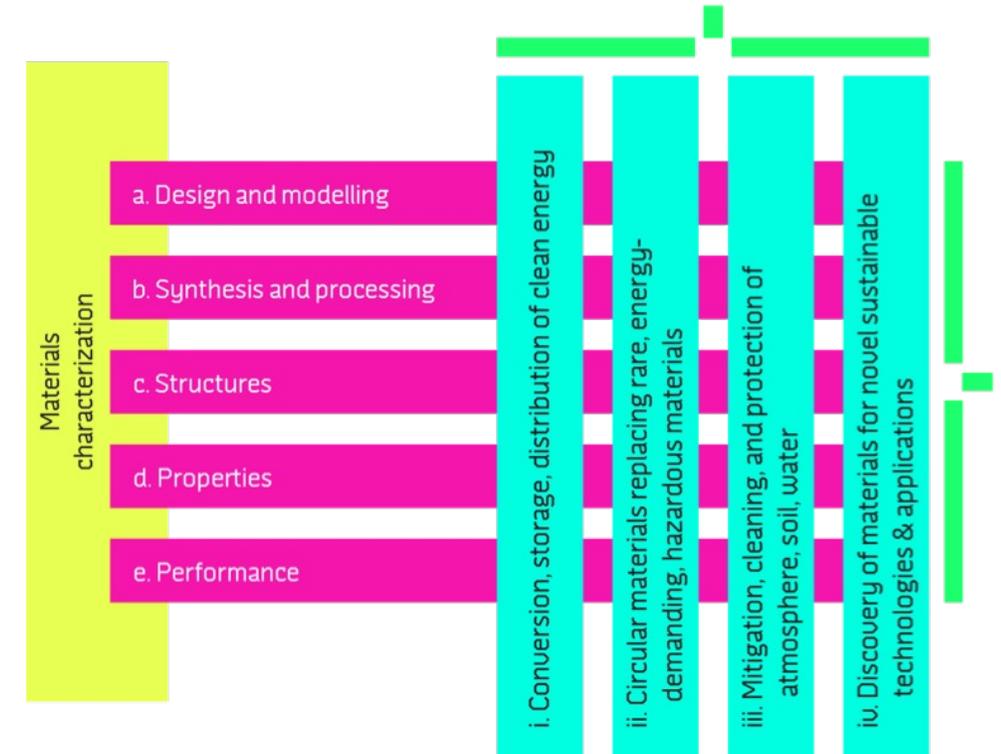
WISE Dialogue 2024:

**CO₂ emissions,
AI in Materials Science, &
Entrepreneurship**

A sustainable future through materials science

The Wallenberg Initiative Materials Science for Sustainability (WISE), is a Swedish research program initiated and financed by the Knut and Alice Wallenberg Foundation.

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WISE Directors & Program Office

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Director WISE



Olle Eriksson
Co-Director WISE



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Research coordinator



Raquel Lizarraga Jurado
Science writer



Daniel Simon
Research coordinator



Cecilia Colliander
Program controller



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Jessica Andersson
Communications officer



Jennie Jordanlov
Event coordinator,
Administrator



Peter Dyreklev
Research coordinator



Nina Grankvist
Research coordinator

University Representative Group

Chalmers University of Technology



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The Chemistry and
Biochemistry
Department



Paul Erhart
The department
of Physics

Stockholm University



**Xiaodong
Zou**
The department
of Materials and
Environmental
Chemistry



**Lennart
Bergström**
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materials and
environmental
chemistry

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Lars Kloof
The division of
Applied Physical
Chemistry



Malin Selleby
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Materials Science and
Engineering

Uppsala University



Cecilica Persson
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Biomedical
engineering



Håkan Rensmo
The department of
Physics and
Astronomy, X-ray
Photon Science

Linköping University



**Johanna
Rosén**
The Institute of
Physics, Chemistry
and Biology



**Klas
Tybrandt**
The Institute
of Technology and
Natural Science

Luleå University



**Marta-Lena
Antti**
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engineering
sciences and
mathematics

Lund University



**Anders
Mikkelsen**
The Synchrotron
Radiation Research



**Kimberly
Thelander**
The Center for
Analysis and
Synthesis

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- Advanced Electron Microscopy [LiU]
- Ultrafast Operando Photoelectron Spectroscopy [SU]
- CircuLab [SU]
- WISE ACT @LUMIA [LTU]
- Chemical Imaging Infrastructure [CTH]
- High-field Materials NMR and MRI [KTH, SU]
- WISE Additive [UU, CTH, LiU]
- Wise-EST [UU, LTU]
- Near Ambient Pressure XPS [LiU, CTH, UU, SU]
- Electron Microscopy Platform [SU, LU, KTH, LiU]
- Materials Fabrication [KTH, LU]

HIGHLIGHTS – 12TH OF JANUARY

WISE invests 500 million SEK in RTP

WISE is investing 500 million SEK (45 million Euros) in research equipment at seven universities in Sweden to establish a national infrastructure platform for materials research for sustainability.



Friday, 15 March

08:30 Fredrik Heinz, WASP

08:50 Ingrid Hotz and Igor Abrikosov, WISE/WASP project, Linköping University

Titel of talk: Advanced data-driven design of sustainable materials through visual exploration and automated analysis

09:10 Lars Nyborg and Vincenzo Gulisano, WISE/WASP project, Chalmers University of Technology

Titel of talk: Quality and Correlations Monitoring in Metal Additive Manufacturing through Efficient Streaming Machine Learning

09:30 Chao Zhang and Rocío Mercado. WISE/WASP project, Uppsala University

Titel of talk: Machine Learning-Accelerated Electrolyte Modelling and Design

HIGHLIGHTS - 30TH OF NOVEMBER

WISE + WASP

Out of the 54 applications submitted, 28 projects were finally approved.

- We are very excited to have launched a collaboration with WISE. Supporting data driven approaches to material science is an excellent example of the enabling role that WASP has in many areas of highest possible societal relevance, says Anders Ynnerman, Director of WASP.

Correspondence

Advanced materials provide solutions towards a sustainable world

<https://doi.org/10.1038/s41563-023-01778-9>

Global challenges, such as anthropogenic-induced climate change, chemical pollution, reduced biodiversity and limited natural resources, require a sustainable solution to develop health and prosperity. Particularly for materials science, we urgently need a new perspective on how to sustainably source materials, use digital tools, design and manufacture products, and apply business models to adapt to market needs. Importantly, this must happen without harming health and the environment while at the same time aiming to decouple the use of raw materials from economic growth.

This is the focus of a recent comprehensive research initiative by the Knut and Alice Wallenberg Foundation, namely the Wallenberg Initiative on Materials Science for Sustainability (WISE; <https://wise-materials.org>). This Sweden-based undertaking involves seven main universities, which operate at the international forefront for discovery and innovation of sustainable materials, as well as innovating necessary competence.

The usage of advanced, efficient and sustainable materials is a determining factor for a worldwide environmental, social and economic transformation¹. For such reorientational science and technology advances offer unsurpassed opportunities to design, synthesize and characterize new materials, where size and characterization are drawn from theory, synthesis and characterization platforms cross-functional and collaborative efforts when different disciplines spearhead the green transition, liaison with academia is crucial for providing a materials revolution. In such a way, relevant instrumentation, software and scientific skills feed the funnel of innovation. To ensure sustainable use of materials, sole use of virgin natural resources is necessary. Energy efficiency, reducing emissions of greenhouse gases, out-phasing of hazardous chemicals, and responsible use of water resources and land that do not threaten biodiversity are among the aspects that should be in focus.

nature materials

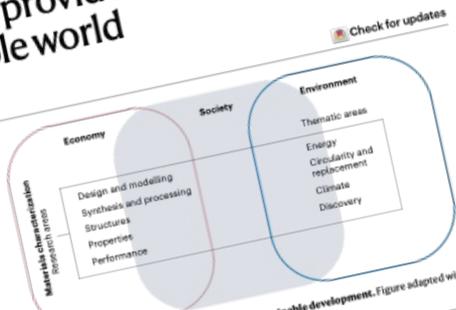


Fig. 1 | The matrix outlining WISE research towards sustainable development. Figure adapted with permission from Ella Kurland and Daniel Simon.

To address these considerations, the United Nations Sustainable Development Goals² provide some guidance to facilitate sustainability. Relevant ongoing research in response to this include construction materials, primarily steel and concrete, with the aim of achieving low or net zero carbon footprint. Currently this sector generates >30 Gt yr⁻¹ of greenhouse gases, primarily in the form of CO₂. Alloys and compounds that enable harvesting, storing, transporting and converting fossil-free energy are also under intense investigation, as are materials for safe production, processing and packaging of food. Naturally these efforts should embrace technologies that do not rely on hazardous chemicals as well as adopting circular use of resources. Research is also focused on materials to extract, purify, store and transport water without contaminating it. Furthermore, efforts are devoted to investigations of materials to interconnect and goods through digitalization and electrical transport. In addition, the exploration of data-science-supported approaches to find new advanced, efficient and sustainable materials is a current trend. In all these efforts it is imperative that contributing to one Sustainable Development Goal should not substantially harm others. Likewise, negative impacts from the usage of devised material should be reduced by life cycle assessments.

The realm of materials research intersects with many disciplines such as engineering, mathematics, chemistry, physics, AI, data science, toxicology and environmental science. Researchers should embrace a broad systems perspective on material use guided by circular principles, including a responsible use of energy, water and land resources. New materials that are designed to grow from less usage of raw materials but function better, that is, 'do better with less', should be encouraged in a resource-constrained world.

We stress the need for researchers to work closely with industry and investors. The legislation, regulation, policies and standardization also need to go in pace with projected scientific and technological developments. Relevant research of WISE is presented in Fig. 1, which also highlights economic, social and environmental aspects.

Urgent tasks for scholars are now to expand the envelope of sustainability and circularity in materials research with a systematic perspective. Because only a small number of possible materials have hitherto been explored, there is a huge potential for innovations. Considerable promise comes from theoretical and experimental exploration of alloys, ceramics, semiconductors and polymers alike.

The development of advanced functional materials is an essential enabler for sustainability, which requires targeted research

Volume 23 | February 2024 | 160–161 | 160

 HIGHLIGHTS – 3RD OF FEBRUARY

WISE reports in Nature Materials

Lars Hultman^{1,2}, Sara Mazur^{1,3},
 Caroline Ankarcróna^{1,3}, Anders Palmqvist^{1,4},
 Maria Abrahamsson^{1,4}, Marta-Lena Antti^{1,5},
 Malin Baltzar^{1,6}, Lennart Bergström^{1,7},
 Pontus de Laval^{1,3}, Ludvig Edman^{1,8},
 Paul Erhart^{1,9}, Lars Kloo^{1,10},
 Mats W. Lundberg^{1,11},
 Anders Mikkelsen^{1,12,13}, Ellen Moons^{1,14},
 Cecilia Persson^{1,15}, Håkan Rensmo^{1,16},
 Johanna Rosén^{1,17}, Christina Rudén^{1,18},
 Malin Selleby^{1,19}, Jan-Eric Sundgren^{1,20},
 Kimberly Dick Thelander^{1,21},
 Klas Tybrandt^{1,22}, Pär Weihed^{1,23},
 Xiaodong Zou^{1,7}, Maria Åstrand^{1,24},
 Charlotte Platzer Björkman^{1,25},
 Jochen M. Schneider^{1,26}, Olle Eriksson^{1,25} &
 Magnus Berggren^{1,22} ✉

¹Wallenberg Initiative Materials Science for Sustainability. ²Thin Film Physics Division,

“Global challenges, such as anthropogenic-induced climate change, chemical pollution, reduced biodiversity and limited natural resources, require a sustainable solution to develop health and prosperity. Particularly for materials science, we urgently need a new perspective on how to sustainably source materials, use digital tools, design and manufacture products, and apply business models to adapt to market needs.”

- Represents all WISE PhD students and postdocs.
- Important forum for the quality- and development work.
- One WISE PhD student and one WISE postdoc from each university. Choose Chair and Vice Chair within this group.
- Term of office normally two years. Half of the representatives are renewed each year. This creates continuity.
- Chair/Vice Chair has regular meetings with the graduate school management and the WISE board.
- Suggests and coordinates informal social activities for the WISE PhD students and postdocs.
- The first group of representatives decided during the special meeting this evening.



PARTICIPATING UNIVERSITIES



FUNDED BY

*Thrut and Alice
Wallenberg
Foundation*

- Startup meeting this evening (all PhD students and postdocs welcome):
- Time: 17:30-18:20
- Place: Group room POST 3
- Goal of the meeting: Formation of the first group of representatives

