Tillaga að verkefni á nýjan vegvísi um rannsóknarinnviði 2025

Titill verkefnis:

Efnisvísinda- og efnisverkfræðisetur

Heiti stofnunar:
Raunvísindastofnun Háskólans, Háskóli Íslands, Háskólinn í Reykjavík, Tæknisetur.

Vinsamlegast hafið eftirfarandi atriði í huga við gerð tillögunnar

Umsækjandi þarf að svara öllum liðum hér að neðan. Þar sem stendur „Texti“ er hægt að skrifa texta, setja inn myndir eða töflur.

Tillögum að innviðum á vegvísi um rannsóknarinnviði skal skilað á þar til gerðu eyðublaði. Ekki er leyfilegt að eiga við uppsetningu eyðublaðsins.

Skjalið „Tillaga að innviðum á vegvísi um rannsóknarinnviði“ skal að hámarki vera þrjár blaðsíður, auk forsíðu, eða samtals fjórar blaðsíður. Nota skal leturgerð og leturstærð eins og stillt er í eyðublaðinu, þ.e. 11 punkta Calibri (body). Ekki er leyfilegt að breyta breidd spássíu eða beyta fyrirsögnum í eyðublaðinu. Umsókn skal senda inn sem PDF-skjal.

Festur til að skila inn tillögum er til 12. september 2024, kl. 15.00.

Nánari upplýsingar er að finna á heimasíðu Innviðasjóðs og hjá sérfræðingum Innviðasjóðs hjá Rannís í gegnum tölvupóstfangið innvidasjodur@rannis.is

Lýsing á tillögu til birtingar á heimasíðu Innviðasjóðs

1. Samantekt: Stutt lýsing innviðum

The Materials Science and Materials Engineering Center (MSE) is an infrastructure collaboration between the University of Iceland, the UI Science Institute, Reykjavik University and IceTec. The aim of the center is to collaborate on building up core infrastructure for advanced materials development and analysis for academic research and industry. For the past four years MSE has established itself as a strong collaboration platform and accessible infrastructure facility with the core infrastructure split between the four main collaborators. Since its founding, MSE has introduced new facilities for advanced additive manufacturing of metals and biomedical components, strengthened the facilities for nanomaterial and device fabrication, contributed to the development of large-scale metal production research, and built a solid foundation for materials characterization using x-ray methods, electron microscopy, tribology and chemical analysis tools. The center has collaborated with and is supported by major industrial companies in Iceland including Össur, Marel, Efla Verkfræðistofa, the aluminium industry and startups and development companies such as Atmonia, Orkusproti and Grein Research.

The science of materials, their production, testing and use in technology, is at the core of modern society. The development of new materials and sustainable processes for their manufacture are essential to solve many of the most pressing issues for humanity in this century. Over the coming years, MSE aims to strengthen the materials science and engineering capabilities available within Iceland creating a platform for academic researchers and development companies to perform high-level materials research and development. This will allow Icelandic researchers and companies to be at the forefront of new technologies in key emerging sectors such as quantum technologies, sustainable metal production, battery technology, advanced manufacturing techniques, geothermal power generation and e-fuels.

An overview of the MSE collaboration and instrumentation available can be accessed here: https://english.hi.is/collaboration/materials_science_engineering_centre_mse_lab

2. Meginmarkmið með uppbyggingu innviða?

The goal of MSE is to create a strong foundation of core infrastructure in the fields of materials science and materials engineering that is accessible to the Icelandic research and development community. This important field is highly reliant on large and advanced infrastructure which is not feasible to acquire and maintain in every research institute. The establishment of the center has allowed combining instrumentation and expertise between different institutions and fields of materials development to create an environment for idea sharing and new cross-disciplinary research.

The main goal of the MSE infrastructure build-up is to allow continued high-level research and development in multiple fields all connected through the foundation of materials. In addition to the continued investment in core infrastructure, several emerging fields have been identified which will be emphasized. These fields include quantum technologies (computing, sensors, data storage), battery technology (solid state batteries, battery recycling, micro-batteries), e-fuel production through electrochemical processes and rapid prototyping by additive manufacturing. An overview of the fields is given below.

Physics/Chemistry	Engineering	Materials production	Additive manufacturing
• Avanced analytical techniques. • Battery development • Nano-materials • High power semiconductors • Clean room facilities • Quantum technologies	• Battery testing • Corrosion science • Metallurgical engineering • Tribology • Composite materials • Electrofuel production • Hydrogen electrolizers • Energy production	• Biotech additive manufacturing • Metal production processes • Molten salt electrochemistry • Physical metallurgy	• 3D metallic printing • Prototype development • Precision fabrication

3. Hvernig mun innviðauppbyggingin stuðla að nýliðun og leiða til aukins samstarfs og betri nýtingar innviða?

Materials science and engineering are the foundation for a number of engineering and science disciplines and a solid foundation of core infrastructure is vital for adequate research-based teaching in these topics. Increased possibilities in training of students and new possibilities for research will strengthen Iceland's competitiveness as workers educated in these fields will play a vital role in the future economy for example highlighted by the fast-growing fields of battery development and electro-fuel production.

The infrastructure needed to be competitive in this rapidly developing field requires significant continued investment and wide-ranging expertise which can only be sustained through expansive collaborations such as MSE. This ensures that infrastructure is accessible and is maintained by the most qualified individuals in each field. The collaboration also enables new researchers to enter the field without needing to have large, dedicated funds to get started.

The facilities already available within MSE are used as an accessible facility available for use by anyone within the Icelandic universities, research institutes and development companies. Instrument and contact information for all MSE instruments is available online. To make the accessibility even better the MSE partners are underway implementing a new lab management system, Clustermarket, which is to become the standard platform for finding and booking research equipment in Iceland.

4. Hverju munu innviðirnir breyta miðað við stöðuna í dag?

The aim of MSE is to bring the Icelandic research and development community to a high standard and provide new possibilities for research and development in Iceland. Continued investment is needed to keep up with the pace of technology development and to be able to address the evolving challenges facing society. The new infrastructure will in particular ensure that we can make an impact in the key emerging fields identified above.

The MSE holds a pivotal role for many research fields, where many different fields unite for similar instruments. Among these fields is the rapidly growing field of electrochemical processes. As Iceland is a frontrunner in sustainable electricity production as well as a major producer of products via electrochemical processes, such as aluminium production, purposeful construction of core infrastructure for this field is of significant importance, while maintaining a strong synergy with other material engineering infrastructure needed for analysis, development of nano-materials and high temperature production. The joint ownership and easily available access to these facilities has increased opportunities for researchers in related fields in Iceland to perform pioneering studies and sparked multidisciplinary collaboration. Strengthening these facilities enables continued access for Icelandic scientist and developers to high level research equipment.

5. Framtíðarsýn uppbyggingar og reksturs

Establishing a wide-ranging foundation for materials research infrastructure the center will enable high level development within currently active research fields. The center will also focus on strengthening the infrastructure for emerging and growing research and development fields. These directions include battery technologies, electrochemical development of electro-fuels, low carbon emission high temperature thermochemical and electrochemical production processes, nano- and quantum materials.

6. Áætluð fjármögnunarþörf næstu ár

The instrumentation MSE proposes to install includes both large-scale instrumentation as well as the introduction of new smaller-scale instruments. These facilities include instruments such as materials analysis tools (x-ray µCT, FIB and EBSD add-ons for SEM), high frequency analysis tools (magnetic and optical nano-materials, microwave telescope development and 5G telecommunications), a physical properties measurement system, materials fabrication tools (electron beam lithography, deposition tools for coating, cleanroom processing facilities etc.), advanced manufacturing and prototyping tools, electrochemistry and battery development instruments and high energy production research and development tools.

An overview of the main instruments and tools planned for installation in the coming years is given below.

Analytical tools (290 MISK)	**Electrochemistry** (90 MISK)	**Nano-materials** (100 MISK)	**Avanced production** (50 MISK)
• X-ray computed tomography (80 MISK) • Physical properties measurement system (70 MISK) • Electron microscopy tools – FIB and EBSD (60 MISK) • High frequency detection tools – FMR and gigahertz detectors (55 MISK) • Ellipsometry instrument (25 MISK)	• Battery development instruments (15 MISK) • Battery testing equipment (35 MISK) • Electro-fuel research tools (25 MISK) • Molten Salt electrochemistry equipment (15 MISK)	• Electron beam lithography (20 MISK) • Cleanroom processing tools (40 MISK) • Deposition tools for coatings and thin films (40 MISK)	• Metal production and physical metallurgy tools (20 MISK) • Precision cutter (10 MISK) • Large prototype AM equipment (20 MISK)