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Global innovations within nanotechnology

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Introduction

- Last session looking at global collaboration, Member priorities in technologies that advance their work, exciting opportunity for blockchain applied into nano
- Opportunity to gain Member feedback on all aspects – help us understand where your priorities are:
  - How we represent you
  - How we develop new opportunities

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EC global relationships

- Based on focus from the European Commission
- Building long term relationships
- Pre-competitive alignment in and out of H2020 – traceability, data, labelling, nanosafety
- As nano community progresses, less about regulatory alignment
- More national contact via ISO and OECD – EU relationships around supporting nanosafety development
- Direct connection with EU usually via H2020 – important programme for collaboration

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A look at the countries

- **USA:** Communities of research. Shared protocols to address research gaps. Nanomedicine and manufacturing
- **Canada:** Cooperation through H2020, focussed through Health Canada. University-university connections primarily with France
- **Brazil:** EC-level cooperation for 4 years, NANoREG had 11 Brazilian Institutes. Delegation in 2017 and collaboration through H2020
- **South Korea:** Active within the NANoREG project and regular workshops in Korea and Brussels. Nanosafety and technical interests for nanoelectronics. Slowly maturing relationship and hope to engage in H2020
- **China:** Nanosafety, publications, however limited replicability as OECD protocols not used. Ongoing discussion however no formal collaboration

Japan: Active in ISO. Ongoing dialogue but no formal collaboration as Japan does not like EC IPR rules in H2020

Iran: Delegation from EC in nanosafety – approx. 10 years behind EU status, with national certification mechanism required for investment/market access

Thailand/Malaysia: Very active in ISO and investing in meeting standards – importing knowledge

Russia: Talk but less action on nanosafety

South Africa: Longstanding cooperation and recent delegation from EU.

Nanotechnology Innovation Council

- Council is a new initiative – aim to capture Member recommendations for priority technologies that advance their development
- Original intention was to focus on novel materials development
- Interesting response from most interviewed Members
- Dream edition – detailed insight into next generation nanomaterials and applications
- Reality edition – Not about materials directly
- Understanding functionality and properties – enabling technologies
- Advancing the ability for intelligent design of materials and nano-structures
- Efficient novel material development is the target, before high impact materials can be selected for market development

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What does this say about the sector?

- Nanomaterials in products are still young
- Reinforces the maturation pathway that sectors need to follow
- More ‘intelligent design’ and predictive safety profiles
- Economic return from materials is end goal but supporting technologies are a major part of sector
- NIA asked to present industry priorities in policy conference next week
- Message – enable the enabling technology

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Power is nothing without control

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Single cell ICP MS

- Inductively coupled plasma phase mass spectrometry – new application in single cells
- Challenge to work on the scale now required for assessment of nanomaterial interaction with biological systems – complex and expensive
- Modelling is logical outcome but need better confidence in characterisation
- Rapid detection and analysis of metal-based particles in a variety of matrices and applications
- Assessed in realistic representation of the nanoparticle as it would be present and behaving when comes into contact with a biological system
- One nanoparticle yields one ion burst, with the intensity of the resulting signal being related to the size of a particle (nm) and the number of pulses being related to the particle concentration
- ICP MS advances the ability to assess how many nanoparticles are in a system and do they enter an organism and at which concentration. Can determine intrinsic metal content of cells in their natural environment
- Parent technology ICP MS going through standards development

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Operating at the nanoscale

- Instrumentation is where key developments are
- Enabling companies to improve understanding of structure-properties at several levels
- Material in isolation and integrated into products where it may contribute to functionality and alter its own form
- Must understand the nanoscale if you are going to actively design functional structures
- Quantum scale control of manipulating electron pairs and a topological approach – interaction at interfaces
- E.g. future in flexible electronics – thin film on human skin to be read by phones

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Microscopy advances

- Multiple advances within microscopy for nanomaterial characterisation
- Increasing ability to characterise ‘soft’ nanomaterials, advancing pharma, food and polymeric assessment
- EM has advanced sufficiently to understand how NMs interact with ions on a molecular level
- Progressing into assessment of NMs and systems in their native state
- Scanning EM, scanning tunnelling EM, helium ion microscopy, atomic force microscopy
- Assessment in fluid and native state
- Advances in microscopy bring more capability in house
- Strong demand for a global characterisation lab directory

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Questions for you

- NIA next steps – more interviews, report more detailed version of nominated technology advances, latest instruments, how companies access them and the services/skills they need alongside
- References and reviews for Members on imaging platforms and their applications
- What do you need to advance your materials development?
- How do you access these technologies? Can we help?
- Not regulatory, not financial (although it is slightly) – focus on the technology