

August 13, 2009

Future Materials
Australian Nanotechnology Alliance

Ms Alison Hemming
Pharmaceuticals, Health Industries and Enabling Technologies Branch
Department of Innovation, Industry, Science and Research
GPO Box 9839
CANBERRA ACT 2601

Dear Ms Hemming,

On behalf of Future Materials and the Australian Nanotechnology Alliance (ANA) we have pleasure in submitting this joint submission expressing our views in relation to the National Emerging Technologies Strategy.

As background, Future Materials is a research institution-based network that connects researchers and industry in the field of advanced materials technology. It provides an independent service for industry creating a one stop shop for materials technology. Future Materials

- organises 'open innovation' technology events,
- links state node managers together into a group pro-actively engaging with companies and supporting each other,
- distributes a plain language materials technology newsletter, and
- maintains a database of industry and research contacts.

The ANA is an industry-led, research supported alliance comprising organisations that underpin Australia's current and future economic growth in diverse industry sectors. Through a range of activities, ANA encourages collaboration and self-assembly¹ between the three key stakeholder groups in the Australian nanotechnology ecosystem: Researchers, Industry and Government, this representing the triple-helix strategy.

While Future Materials and the ANA are two separate organisations, we share a strategic alliance that encapsulates our belief in collaboration through open innovation principles. Aligning Future Materials' foundations within research organisations and the ANA's industry focus provides a catalyst for economic development utilising new and advanced materials.

1. What are the key issues and challenges that need to be addressed by the National Enabling Technologies Strategy?

¹ The term Self-Assembly in the classic sense relates to *the spontaneous and reversible organization of molecular units into ordered structures by non-covalent interactions*. The first property of a self-assembled system that this definition suggests is the spontaneity of the self-assembly process: the interactions responsible for the formation of the self-assembled system act on a strictly local level—in other words, *the nanostructure builds itself*—at the ANA we support this chemical reaction in the networking process.

The central thrust of what Future Materials and the ANA would be seeking through NETS is a clear and well articulated vision of the Australian government's support for emerging technologies including materials sciences² and nanotechnology. As enabling technologies, materials science is and will continue to play a significant role in Australia's economic development and provide employment opportunities, with figures quoted just for nanotechnology of between \$50B and \$60B and employing 125,000 Australians leading to a significant increase in productivity gain.

Work undertaken at the federal and Queensland level showed that industry groups and consumers have confidence in nanotechnology in most cases, and sees that it offers better alternatives to products in a wide range of markets from health, environment, consumer goods, transport and electronics.

It must be said that the confidence of industry and researchers both in Australia and internationally was dented when, following the last federal election, the message regarding the direction and future of Australia's nanotechnology policy was not articulated clearly. There was concern from both within and external to Australia that the government was moving away from a commitment to nanotechnology. Added to this, the cessation of the Australian Office of Nanotechnology to be absorbed into a broader body has also raised similar concerns. Future Materials and the ANA hold great hope that NETS will be a catalyst that cements commitment and bridges Australia's strong R&D focus, which we are internationally renowned for, to strategies that encourages education and industry collaborations that we know lead to strong innovation outcomes.

It must also be understood and articulated that emerging technologies, like nanotechnology and other materials science, are enabling technologies. They are not industry sectors in their own right, unlike biotechnology and ICT which are both emerging technologies and industry sectors.

As an enabling technology it means that methodologies can be used alone or in combination with associated technologies that provides the means to generate giant leaps in performance and capabilities of goods. This provides opportunities for Australian industry, regardless of their size, to compete in areas they otherwise could not.

Through this review period, Future Materials and the ANA would encourage the NETS review strategists to examine the approach undertaken by the European Union. Over this decade the activity it achieving innovation across many industry and market segments by taking a consolidated approach that successfully incorporates a combined education and research activity and industry.

The European Union *Knowledge Triangle* brings together education, industry and innovation. Through a similar model implemented in Australia, Future Materials and the ANA believes there will be a focus on increasing the awareness of materials science to organisations that are initiated (currently use or are about to use) and uninitiated (do not use).

² In the future, Materials Science will be the generic title which encapsulates Nanotechnology.

Added to the issues raised above, Future Materials and the ANA provide the following opportunities highlighting additional challenges that we recommend to be addressed by the NETS review:

- Australia lags in the establishment of linkages that encourage research to research (R2R) and collaboration between industry and research (I2R). Australia currently sits at the same position that the European Union was some 10 years ago when they realised that global competition in the current materials science environment was strong and European countries were being surpassed in their commitment to research and development and to high-tech outputs.

The EU understood that without a science strategy that encouraged synergy between the stakeholder partners including research and education, industry and government, GNP and consequently jobs would decline having a serious impact on industrial capability and national prosperity. It was envisaged that 10 million jobs in the EU could be developed through the up-take of materials science.

Some of the solutions examined by the EU based on the EC model of the Knowledge Triangle (education, industry, innovation) included:

- Establish stronger links among the researchers in the European countries involved in the field of advanced materials; plus other European countries not in the Union
- Advocate for a more efficient and more transparent research and development policy in Europe
- Develop a new model for innovation, bridging research to industry and investors
- Structured a process for a testing facility for nano-scale devices at the European Institute of Technology (EIT)
- Launch common actions through the existing European instruments. These actions included the four EC pilot projects examining (a) complex electronic systems; (b) transportation; (c) climate and energy; and (d) regenerative medicine.

While Australia does not have the advantage of a significant trading block, there are crucial lessons that the Europeans have established over the last 10 years that Australia can gain from. Future Materials and the ANA encourages the Department of Innovation, Industry, Science and Research through this review to closely examine the structures and history that the EC adopted. The lessons are crucial for Australia, especially the necessity to accelerate innovation through stakeholder collaboration, from both within Australia and internationally.

- **Education:** Future Materials and the ANA interpret education to be significantly more important than a commitment to science education in our schools and tertiary institutions.
 - Continued commitment to research and development in Australian tertiary and publicly funded institutions

- Continued commitment to building the network and research collaborations between these research organisations
 - Encouraging the study of science from primary school age utilising science specific teachers (as we see with arts, music and physical education).
 - Assisting the important work Future Materials is doing to encourage industry to be aware of the facilities availability to industry in analysis and characterisation
 - The cessation of funding under the ARC for the ARCNN (ARC Nanotechnology Network) and ARMAN (Australian Research Network for Advanced Materials) which provides opportunities for early career researchers and PhD students to link and learn is a serious setback. Future Materials would welcome the opportunity to work with NETS and these networks to examine project funding that would see their crucial work continue. The work includes encouraging careers in science, assistance in providing Australian students with funds to travel overseas, an annual conference providing knowledge in presentation skills, careers and networking and attracting and providing a network to international students.
 - The continual funding of educational conferences that brings together Australian and International players from all areas of the materials science eco-system including researchers, industry and government representatives.
- **Industry:** Industry requires from governments a clear and articulated vision. Added to this, it needs the vehicles to provide assistance, links and entrepreneurial guidance.
- Crucial is the commitment of project funds in which organisations like Future Materials and the ANA can apply to deliver activities in line with knowledge transfer and open innovation.
 - Examine public awareness programs that are not solely aimed at “initiated” firms (ie those already using materials science), but broader programs that allow small and medium firms, plus those currently not utilising materials science to have the knowledge and confidence to move forward.
 - The examination of a web-based facilitation mechanism that enables industry with problems to connect with researchers to develop solutions. The current Future Materials portal on their website (www.future.org.au) is a first generation model with need for improvement.
 - Ensuring regulations are not duplicated and onerous to industry, and wherever possible examine self-regulation. Regulatory frameworks which are barriers to industry are not acceptable.
 - For SMEs involved in a particular sector mentoring programs that identify common problems and work (with government funds) to

find a research solution eg marine sector with coatings and corrosion.

- **Innovation:** through delivery of a policy committed to education (including research) and industry it is inevitable that the result is economic growth.
 - The emphasis Future Materials and the ANA have outlined in this document is an innovative and integrated approach to the challenges Australia faces in education, research and innovation. What needs to happen is the continued building on our successes and to contribute to future achievements.
 - The European *Knowledge Triangle* model was inspired by the need to build together organically the worlds of business, research and teaching. While Australia undertakes excellent research, matched by excellent teaching and permeated with entrepreneurial intelligence, there lacks strategies to tie these areas together.
 - There is a necessity for infrastructure resources that allows testing of materials and products, plus scale-up facilities. Due to the sophisticated nature of these analytical facilities (microscopy and synchrotron) an innovation intermediary would facilitate the engagement with industry. This would allow the full capability of these advanced resources to realise the innovation potential for industry.
 - In Australia today, education, research and business often inhabit separate worlds, with little interaction between them. There are many reasons for this – many of them plausible. But it is unsatisfactory and we can do better, NETS provides the strategy for us to achieve better.

2. How should these issues be addressed

The Australian government needs to develop a clear and well articulated strategy on materials science, as has been noted above. This policy is not solely about research and building on the success we have in this field. It is about networks and networking.

The policy needs to articulate the difference between emerging technology industries and emerging technology in enabling technologies. Through this differentiation and the selling of this message by our government leaders, it will help industry (especially in the uninitiated categories) to see that this policy is inclusive of them and offers them opportunities to build their enterprises.

- Key is the commitment of central government funds to the continuation of networks that ensure the Knowledge Triangle of education, industry and innovation and that have a track record in networking and communicating with the stakeholders.
- This document has spent much time articulating the European model which Future Materials and the ANA believe is one of the very best. We would very much encourage a delegation of industry networks and government people to meet with our European counterparts to open dialogue in the policy area. We believe this will

translate into a broader knowledge base and provides an Australian/EU commitment that has lagged in recent years.

- Future Materials and the ANA have developed a list of projects that we would seek funding through NETS that will cut down the barriers and engage stakeholders. These include:
 - Build on current Future Materials and the ANA knowledge transfer seminars in capital cities throughout Australia that showcases research and industry and how it can successful operate.
 - Development of knowledge transfer seminars that are aimed at each State's competitive advantage industry sectors that provides not only information but also the research links. These seminars should be taken regionally and would require having the commitment of both the Federal and State governments.
 - Involvement in domestic and international conferences
 - International missions that allow policy representatives either in industry networks and government to learn what is happening in overseas markets
 - International missions of industry and researchers to important materials science conferences
 - The establishment of a new generation web based networking tool
 - Resources allowing industry specific Professional bodies to liaise with emerging advanced materials and nanotechnology networks in order to facilitate education and awareness raising
 - Demonstration projects such as a demonstrator project on corrosion and coatings.
 - Development of case studies (web based and hard copy) which show what nanotechnology entails, through to showcasing successful collaborations.
 - Development of web-based pod-casts and vod-casts (video) that can be watched or listened to at times suitable for individuals.
 - Capability reports of materials science stakeholders
 - Innovation report of materials science industry solutions
 - The establishment of "entrepreneurs" that mentor industry sectors or individual companies to navigate through the labyrinth and effectively engage with universities and public research facilities, find relevant information available in a particular area and identify funding.
 - Establishment of Materials Science Industry Forum as a group that the Minister and senior public servants can liaise with.
 - Database

3. **Who needs to be involved and how that involvement can be facilitated.**

It is important to restate that network and peak bodies like Future Materials and the ANA need (and want) to be part of the solution. Our organisations offer a multi-level range of solutions. Added to this, organisations to be involved in the process should include:

- Linkages to domestic and international research and policy organisations
- The ability to link with Australian industry and provides knowledge transfer and links to the researchers or existing products
- Educational facilities
- Networks like ARNAM and ARCNN
- State Government's need to move in the same direction
- Community involvement

Future Materials and the ANA are available to discuss this submission in further details.

Yours sincerely

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Director and CEO – The Australian Nanotechnology Alliance