

Supporting international cooperation in environmental nanotechnology

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Abstract

The ICPC-NanoNet project can support international research cooperation in environmental nanotechnology between the European Union and International Cooperation Partner Countries to the EU (emerging economies and developing countries). This article focuses on the case of nanotechnology for water purification.

Introduction

Currently, potential and actual applications of nanotechnology in environmental technologies are receiving considerable attention worldwide. Relevant applications include environmental remediation (air, water and soil), monitoring, and resource saving (energy and materials). These technologies are not only intended for markets in wealthy countries, including in Europe, the USA and Japan, but may also be particularly useful for protecting consumers and the environment in emerging economies and developing countries. Furthermore, research groups and companies in emerging economies and developing countries are increasingly active in R&D and manufacturing environmental nanotechnologies, as part of a national knowledge economy. International cooperation in environmental nanotechnology research involving universities and companies from North and South is expected to bring benefits to both sides. The European Union fosters such research cooperation by opening up the current Seventh Framework Programme for RTD (FP7, 2007-2013) to participants from outside the EU. Research groups from emerging economies and developing countries can participate as additional partners in EU funded research projects and receive funding from the EU. The projects should always be coordinated by a European organisation. However, a bottleneck has been created by the lack of visibility of excellent research groups in emerging economies and developing countries to their European peers. The ICPC-NanoNet project www.icpc-nanonet.org is funded by the EU to help overcome this problem.

Aims and scope of the ICPC-NanoNet project

ICPCNanoNet is funded by the EU under FP7 for four years from 1st June 2008. It brings together partners from the EU, China, India, Russia and Africa and aims to provide wider access to published nanoscience research and opportunities for collaboration between scientists in the EU and International Cooperation Partner Countries. Specifically, the project provides:

- An electronic archive of nanoscience publications, freely accessible to researchers around the globe: www.nanoarchive.org;
- An electronic database of nanoscience organizations and networks in ICPC at www.icpc-nanonet.org;

- An electronic database of nanoscience researchers and stakeholders across the globe at www.icpc-nanonet.org;
- Annual reports on nanoscience developments in eight ICPC regions: Africa, Caribbean, Pacific, Asia, Eastern Europe and Central Asia (EECA), Latin America, Mediterranean Partner Countries (MPC), Western Balkan Countries (WBC) at www.icpc-nanonet.org;
- Online networking tools including a discussion forum at www.icpc-nanonet.org and teleconferencing/online workshop facilities to support networking between peers in different world regions (info at www.icpc-nanonet.org);
- Annual workshops in the EU (Prague, 1 June 2009), China (Beijing, 14-15 June 2010), India (in 2011) and Russia (in 2012). These will also be webcast live to facilitate greater access.

Nanotechnology for Water Purification

How can the ICPC-Nanonet project be useful to researchers in environmental nanotechnology? The recent ICPC-Nanonet online workshops examining nanotechnology for water purification is a case in point. Worldwide 1.1 billion people have no access to safe drinking water. Each year, there are 4 billion cases of diarrhoea, including 88% due to unsafe water; and 1.8 million people die each year because of unsafe drinking water. (WHO/UNICEF: Water for Life, Making it Happen, 2005, quoted by Patrick Dunlop, University of Ulster). Nanotechnology is expected to contribute to water purification in a number of ways. Eugene Cloete of the University of Pretoria lists the following: filtration, surface modification, monitoring, bio-adsorption and remediation, antimicrobials, photocatalysts and desalination. Excellent research groups specialising in this area can be found in South Africa and other emerging economies and developing countries as well as in Europe and North America, but a lack of awareness of each others' expertise and research infrastructure, as well as relevant funding opportunities, hampers international cooperation. The report "Nanotechnology, Water and Development" published in 2006 by the Meridian Institute includes an overview of the issues and available technologies as well as case studies in Bangladesh and South Africa (Hillie et al, 2006)

Teleconferences

To help overcome the lack of visibility of excellent researchers, ICPC-NanoNet organised a series of three free teleconferences in December 2009 on nanotechnology for water purification, featuring experts in this field from Europe and South Africa. The topics discussed include 'Control of Biofouling in Nanofiltration Systems' (by Prof. Dr Eugene Cloete, Head of the Microbiology Department of the University of Pretoria, South Africa); 'Functionalized nanotubes/polyurethane composites for the removal of chlorinated organics in water' (by Dr Rui Krause, Department of Chemical Technology, University of Johannesburg, South Africa); 'Water Treatment in Developing Regions – Using Nanotechnology to Enhance Solar Disinfection' (by Dr Patrick Dunlop, University of Ulster, Northern Ireland, UK); 'Nanotechnology for Water Treatment: Promises, Questions and Detection of C60' (by Dr Bas Hofs - KWR Water Cycle Research Institute, The Netherlands); 'Photocatalytic Decontamination of Water by Nano-TiO₂: Perspectives and Challenges' (by Dr Lorette Scifo - LABEIN Tecnalia, Spain); and 'European funding possibilities for European and non-European researchers' (by Ineke Malsch, Malsch TechnoValuation). For each of the three

sessions more than 80 people registered, but due to technical constraints participants who attended numbered around 20-25. The presentations gave rise to lively, stimulating discussions of technical, economic and safety issues. The presentations and slides highlighting the research interest of several other participants are available free at the ICPC-Nanonet website for registered users, who can continue their discussions on the online forum on the website or by contacting the relevant experts directly. Nanoscientists from Europe or from the International Cooperation Partner Countries to the EU are welcome to propose their own teleconference/online workshop related to nanotechnology, which can be organised by ICPC-Nanonet on request. (contact Lesley.tobin@nano.org.uk)

Databases

Searching the online organisations database at www.icpc-nanonet.org by keyword “water” resulted in 40 hits (January 2010). In general, 81 of the currently 790 organisations in this database are active in nanotechnology for environmental applications. These organisations are all located in International Cooperation Partner Countries to the EU. This means they are in emerging economies or developing countries. 2502 European research organisations and companies active in nanotechnology are included in the online database at www.nanoforum.org. This includes 173 organisations in safety and environment, of which 11 are water-related.

The researchers’ database at www.icpc-nanonet.org holds 358 records including 131 whose interests include environmental applications. These researchers come from all over the world including Europe, Asia and Pacific, North and South America and Africa and are all self-registered. Nanoscientists and stakeholders who are not yet included are welcome to register themselves in this database, Registration is free.

The nanoarchive www.nanoarchive.org currently contains 5517 peer reviewed publications, including 42 in nanotechnology for environmental applications. About 685 records are connected to the full text either as a pdf or through a link to the corresponding author. Nanoscientists are welcome to upload their own publications to the nanoarchive, respecting the copyright rules of the publisher. (contact Lesley.tobin@nano.org.uk)

Annual reports

The ICPC-NanoNet annual reports 2009 review nanotechnology activities per country in eight world regions: Africa; Asia (East and West); the Caribbean; Eastern Europe and Central Asia; Latin America; Mediterranean Partner Countries; Pacific; and Western Balkans. In Africa, the Nanocentre for Africa located at iThemba Laboratories for Accelerator Based Science in South Africa is an international research centre with a strong focus on nanotechnology and water. The NanoAfNet network incorporates 318 researchers from 30 African countries. Water purification is among their research interests. In Nigeria, production of nanoporous filters for water-purification and bio-oxidants is one of the four major areas relevant to the country’s needs as identified in a workshop organised by the National Agency for Science and Engineering Infrastructure (NASeni) in 2006. The results of this workshop have led to the inclusion of nanotechnology for water purification in the national funding policy as expressed in the Nigerian Nanotechnology Initiative. In South Africa, nanotechnology for water purification is one of the social priorities in the national nanotechnology strategy. Water purification is also targeted in the IBSA network, which brings together nanoscientists in India, Brazil and South Africa. Several research organisations in South Africa are engaged in

relevant research. (Tobin, 2009) In Asia, water purification has been a priority of the ten-year Iranian Nanotechnology Initiative since 2005. However, a SWOT analysis evaluating the programme concluded that many areas of nanoscience and technology including water treatment are left out. (Kulkarni et al, 2009) In the Caribbean, one university in Trinidad and Tobago is interested in nanotechnology for water purification. (Newton & Hyttel, 2009a) In Latin America, research groups and networks are working on nanotechnology for water treatment in Brazil, Chile, Mexico and Peru. (Malsch, 2009) Finally, in the Mediterranean Partner Countries, research groups are active in nanotechnology for water treatment in Algeria, Egypt (e.g. in cooperation with Italy), Morocco (in cooperation with Spain and France), Tunisia and West Bank. (Newton & Hyttel, 2009b)

Conclusions

Researchers interested in international cooperation in environmental nanotechnology can use the information available on the ICPC-Nanonet website and the networking tools, including teleconferences, an online discussion forum and publishing their research interests in an online researchers' database to establish contacts with peers in other world regions. The EU Seventh Framework programme for RTD offers funding in regular calls for proposals published once or twice a year at the CORDIS website <http://cordis.europa.eu/>.

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