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***The list of priorities is intended to facilitate informal discussions in the Member and Associated states with your key stakeholders. This, and all related information, is NOT intended for wide circulation by electronic or any other means. Please use copy-paste function for particular parts of interest ONLY.***

The list reflects the current, very early stage state-of-play in terms of input given to H2020 work for 2014-2016 in the nanotechnology field. The proposed priorities will be subject to a number of internal (within DG RTD) and inter-service meetings and consultations before a work programme draft is prepared and presented to the formal H2020 governance structures. As discussions with the Council and the EP are still ongoing, including the budgetary aspects of H2020, no conclusions can be drawn at this stage how many of the identified priorities will be supported under the first work programme.

The priorities are divided in several areas (value chain topics – from the Nanofutures Roadmap; H2020 Focus Area topics – from ongoing work ; Cross-sectorial actions – from policy) and labeled Y1, Y2 and Y3, referring to the callyears 2014, 2015 and 2016 respectively.

The outcome of the project is also indicated by the Technology Readiness Levels (TRLs):

1. Basic Research
2. Technology concept
3. Proof of Concept
4. Lab validation
5. Validation in relevant environment
6. Demonstration in relevant environment
7. Demonstration in operational environment
8. System complete and qualified
9. Deployment

## Identified priorities from the Nanofutures Roadmap after Member States consultation

## VALUE CHAIN 1: Lightweight multifunctional materials and sustainable Composites

1. Nano-enabled Multilayer barrier materials, Y1, Pilot lines up to TRL 7

2. Cost effective industrial scale technologies for synthesis and technologies for dispersion/exfoliation (extrusion), Y1, Open access pilot lines, up to TRL 6

3. Synthesis and functionalization of particles for functional nano-inks used in flexible and rigid electronics, Y1, Pilot lines up to TRL 7

The micro-electronics industry is currently centred on silicon based materials and on fab based manufacturing which translates to high capital investment, batch processing and limited adaptability in terms of substrate size. Vacuum based technologies combined with lithography are widely used deposition and patterning processes for a wide number of metals and metal oxides layers in the microelectronics industry that has recently been adapted for use on large area substrates via R2R, representing a large advancement when compared with the conventional batch processes. A strong contribution to reduce cost of composite components is expected

through migration to ink-based, simple and safe deposition process through the development of suitable inks formulations.
The call topic aims at developing and synthesizing inorganic and hybrid materials contributing in the migration toward low cost liquid based deposition and patterning processes as ink jet, and screen printing compatible with plastic substrate and roll-to-roll systems.

### 4. Integration of novel nano materials into existing production and assembly lines, Y2, Pilot lines up to TRL 8

### 5. High performance nano composites, Y2, Pilot lines up to TRL 8

### 6. Analysis and process control of dispersion of nanofillers into polymers, Y2, Metrology R&D up to TRL6

### 7. Precise control of morphology in nanoporous materials, Y2, Metrology and process development up to TRL 6

The interest in nanostructured porous materials is continuously growing thanks to the many applications that can benefit from the adoption of a controlled porosity at the nanoscale. Typically a nanoporous system has a pattern of pores of diameter between 1 and 100 nm. Nanoporous materials show many kinds of pore geometries, structures and chemical compositions and possess unique surface, structural, and bulk properties that underline their important uses in various fields such as ion exchange, separation, catalysis, sensor, thermal insulation and purifications. Nanoporous materials are also of scientific and technological importance because of their vast ability to adsorb and interact with atoms, ions and molecules on their large interior surfaces and in the nanometer sized pore space The call topic aims at developing of reliable processes control and manufacturing routes to obtain nanoporous materials with control on the porosity distribution. The nanoporous materials should focus for example on combinations of improved mechanical properties, reliable permeation rate, high electrical resistance or other thermophsyical and transport properties. The research topic aims at development and optimization of bottom-up and topdown processes that could be, but is not limited to, Chemical synthesis, 3D printing/assembling, (Laser)structuring, Pyrolysis of polymer or ceramic networks, physicochemical synthesis via precursors.
The projects are encouraged to demonstrate the effectiveness of the proposed and developed approaches and technologies through a pilot line aimed to the production of semifinished products. The market viability of the pilot line shall be clearly evaluated. The process and the material proposed should support and reflect developing guidance and standards relating to nanomaterials aspects. The application fields interested by this topic could be, but are not limited to, nanoporous materials for: efficient gas storage and trapping, long-life nanoporous electrets, filtration and nanofiltration, medicine for scaffolds.

### 8. Cost effective industrial scale synthesis and technologies for nanofibers, Y3, Pilot lines up to TRL 7

## VALUE CHAIN 2: Nano-Enabled Surfaces for multisectorial applications

### 9. Processes for a new generation nano-structured thin films and coatings on rigid and semi-rigid organic and metallic substrates, Y1, Pilot lines up to TRL 7

The development of advanced processes to produce nano-structured surface or large area multifunctional organic and inorganic thin films has been hindered by the difficulty to monitor and control during processing the complex nano-structured of surfaces responsible for their properties. In order to be competitive in the global market, manufacturing industry needs to be cost-efficient and flexible in volume and product features, meeting at the same time quality and sustainability targets. The advent of nanotechnology has enabled tailoring the structure of coatings and thin films at the nanoscale down to the scale of atoms, subsequently producing a radical enhancement of their performance. Research is required for the development of an atomistic process and thus allows a control of the nano-structuring of surfaces down to the scale of atoms.

The expected projects should be focused on the scale-up of innovative laboratory-scale processes to pilot-line-scale for industrial application. The projects should consider the development of novel nanostructured coatings and thin films with markedly enhanced properties such as chemical inertness (e.g. oxidation, corrosion), UV resistance, bioresistance as well as the study of novel structures, surface modification, multilayers, and a new generation of nano-enabled thin film on rigid organic and metallic substrates. Priority is to be given to enabling nanotechnologies that are mature enough to be integrated within existing or new production lines, with the highest potential to promote industrial application of nano-engineered products. The expected projects should include appropriate modeling to design and predict processes and production lines. The goal is thus to facilitate the transfer from laboratory-scale activities to larger scale processes that would open the way for…

# VALUE CHAIN 3: Structured surfaces

## 10. 2D - Printing with higher definition (S2S), higher throughput (HE), higher throughput, higher definition (NIL, Litho & Laser ablation and writing), Y1, Pilot lines up to TRL 6

2D and 3D printing with higher definitions and possibly higher throughput to achieve the industrial needs are the main objectives of this call. Increasing the resolution and overlay accuracy via advanced methods such as topology-induced printing are needed to be developed. The focus of the development is on more advanced materials such as ceramics, bio materials and dielectrics enable new products and market. Especially current techniques such as jetting technologies are not suitable for low shear, low temperature restriction materials.

## 11. Patterning and etching techniques for the development of magnetic nanostructures, Y1, R&D up to TRL 4

Europe holds a strong position in nanosciences that needs to be translated into a real competitive advantage for European industry. Exploration of new concepts and approaches for sectorial applications, including the nanostructuration of surface and convergence of emerging technologies at the nanoscale, are needed to promote the development of an RTD-intensive European nanotechnology related industry. The improvement of self-assembling technology in order to have higher throughputs require strong research activities in order to evaluate reliability and products. Selforganisation is a very promising approach, in particular regarding cost effective upscaling.

Current bottom-up structuring wet processes include bead self-assembly, block copolymers, selective molecular assembly, molecular lithography, …, thus addressing micro-to nano- scale. Of central importance for applications are structures with controlled properties over multiple scales, multi-component structures, and the connection of self-ordered systems with conventionally produced structures and functions. Research on patterning and etching techniques is required for the development of (magnetic) nanostructures by self-assembling and self organisation aimed at motifs capable of generating new architectures and functionalities. Research will focus on developing new knowledge-based multifunctional 2D large area surfaces and materials with tailored magnetic properties and predictable performance, for new products and processes targeting a wide range of applications.

# VALUE CHAIN 4: Functional Alloys, Ceramics and Intermetallics

## 12. Compatibility of new nanomaterials with existing processing steps for the production of advanced functional alloys, ceramics and intermetallic compounds, Y2, Demonstration projects up to TRL 7

The availability of new materials and nanomaterials has significantly increased in the last decade but in many cases their penetration in the market is limited by difficulties in the manufacturing chain. The integration of nanomaterials with existing technologies can dramatically enhance material performance. In order to maximize nanomaterial-enhanced performance, nanomaterials must be integrated without destabilizing or agglomerating the material. By understanding and controlling the physicochemical state of the nanomaterial through each step of the manufacturing and carefully controlling the processing parameters, nanoparticles can be integrated into the final product and performance optimized.

An integrated solution should be developed to preserve the nanostructure and the nanomaterials in each step of the manufacturing chain for advanced functional alloys, ceramics or intermetallic compounds in order to arrive at the final product with the designed performances. The projects should focus on definition of pilot chains and process control tools able to use existing processing steps in order to accelerate the penetration in the market of nanomaterials.

The projects should also evaluate suitable synthesis strategies with respect to materials quality and high volume production, typically above 100 kg/day. The synthesis methods could be, but are not limited to, Physical/mechanical methods, chemical synthesis (mostly wet phase/gas phase), hybrid technologies and high energy milling. The definition of the pilot applications should also embrace the issues related to shelf storage and shipment of the nanomaterials and the final products. The projects are encouraged to demonstrate the compatibility with developing guidance and standards relating to nanomaterials aspects as well as all current applicable regulations.

### 13. Characterization - of hosted nanoparticles and nano-aggregate systems. Physical, chemical, phase-structure, size and shape measurements on candidate hosted nanomaterials and nanoaggregates. Measurements on material systems created in material synthesis projects, Y3, Metrology research up to TRL 4

Description to follow

## VALUE CHAIN 5: Functional fluids

### 14. Manufacturing processes for synthetic nanomatrices and nanocapsules, Y1, Demonstration projects up to TRL 6

Encapsulation technologies have been widely used for a long time in the pharmaceutical industry for drug delivery applications. The emergence of nanotechnology and the availability of novel tools have paved the way for new type of particles which can be used for targeted delivery and that can carry drug payloads for localised action. Such technologies are increasingly applied in nanomedicine but also in a wide range of consumer products, like cosmetics, household cleaning products etc. In this call non-food applications should be taken into account.

Different types of inorganic nanomatrices and nanocapsules are required depending on the nature of the material (hydrophobic or hydrophilic) to be incorporated. The release of the payload could be organised by an external trigger (ultrasound or magnetic field etc.) or the materials can be designed to release the payload depending on the environment (pH,temperature, light exposure etc.).

Further research is needed in order to develop safe, controlled and reliable manufacturing processes of nanospheres, nanocapsules, oleosomes and liposomes, inorganic nanomatrices etc, containing active ingredients (e.g. drugs in nanomedicine, or vitamins or anti-oxidants for cosmetic products, of cleaning and antimicrobial agents for housecleaning products). The production techniques involved, such as coacervation or phase separation, are important because they may improve the stability of the nano formulation and the 'active ingredients' involved. Safety testing and standardization is very important in this field.

### 15. Modelling of fluid-surface interfaces of functionalized particles, Y2, Modelling, up to TRL 5-6 (4?)

The future of the European nanotechnology industry is associated with a strong modelling and simulation capacity. Already the NMP.2013.1.1-4 call topic (Development of an integrated multi-scale modelling environment for nanomaterials and systems by design) outlined the overarching ambition to create an open, integrated and multi-purpose numerical nano-design environment to shorten the development process of nano-enabled products and to increase global competitiveness of our industries. Projects under the present call have to collaborate with projects of the 2013 call and other nano-related modelling projects to further develop and augment the capacities of an integrated multi-scale modelling environment. A link to application specific data repositories and the overall harmonized development of new simulation modules is a key element in achieving the long term goal of a nano-design environment.

The present call focusses on the understanding and controlling of the properties of fluid interfaces and functionalization particles. This is relevant to develop materials of industrial interest (personal care products, cosmetics, pharmaceuticals, painting or lubrication), to design engineering processes, and to understand fundamental scientific problems. There is a need to develop methodologies to understand, explain and predict the structural and dynamical properties of fluid interfaces. Interfacial functionalization is important to tune the properties of materials. The possibility of functionalizing interfaces with particles of different sizes is opening a new route to control the interfacial properties and to make a new class of soft materials.

Projects should aim to bring together experts in computer simulation and theory of interfaces to establish the state of the art in the theoretical investigation of the structure and dynamics of interfaces, as well as to delineate short-term objectives for the development of computational tools to assist in the design of functional interfaces and products enabled by these.

### 16. Modelling of nanoparticles and microfluidic behaviour (for microfluidic devices, bio-chips etc.),Y2, Modelling, up to TRL 4

The future of the European nanotechnology industry is associated with a strong modelling and simulation capacity. Already the NMP.2013.1.1-4 call topic (Development of an integrated multi-scale modelling environment for nanomaterials and systems by design) outlined the overarching ambition to create an open, integrated and multi-purpose numerical nano-design environment to shorten the development process of nano-enabled products and to increase global competitiveness of our industries.

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The present call focusses of the investigation and modelling of phenomena related to microfluidic behaviour. The behaviour of fluids at the microscale can differ from macrofluidic behaviour in that respect that factors such as surface tension, energy dissipation, and fluidic resistance start to dominate the system. Microfluidics studies how these behaviours change, and how they can be worked around, or be exploited for new uses. In particular

at nano scales promising and sometimes unintuitive properties appear. For instance, the Reynolds number can become very low. As a consequence, fluids, when side-by-side, do not necessarily mix in the traditional sense; molecular transport between them must often be through diffusion. Application areas are micropneumatic systems, i.e. microsystems for the handling of off-chip fluids (such as liquid pumps, gas valves, etc.), and microfluidic structures for the on-chip handling of nano- and picolitre volumes.
Projects should focus on modelling emerging application areas for biochips like clinical pathology, especially the immediate point-of-care diagnosis of diseases or microfluidicsbased devices, capable of continuous sampling and real-time testing of air/water samples for…

### 17. Analysis and process control of dispersion of nanofillers into liquid, Y2, Metrology, R& D up to TRL 5-6

Functional fluids obtained by combination of liquid matrices and specific nanofillers have numerous potential industrial applications in large consolidated market (trasportation, micro-electronics, industrial and constructions applications) and emerging sectors (flexible electronics, consumer products and medicine/biotech). The direct use of functional fluids (as lubricants, refrigerants, magnetorehological…) could achieve lower emissions, resources savings and compact systems; indirect use of new fluids could promote higher quality and lower cost processes (deposition technologies as spraying, inkjet, screen printing…). Today, numerous nanoparticles with various functional properties (electrical and thermal conductivity, magnetical, metals, semiconductors, low friction…) and different shapes are produced; the limitations in their use are related to quality associated with the aggregation and dispersion which requires specific characterization and process control tools in order to optimize systhesis methodologies, improve mass production (cost reduction).
This research topic aims at development and optimization of the combination between functionalized nano particles and liquids (aqueous and organic solvents); projects should address different physical and chemical methods for characterization as well as process control tools in order to improve functionalization and production of functional fluids; analysis of dispersion, aggregation and sedimentation of nanoparticles with direct effects on final properties should also be addressed.

### 18. Modelling for optimization of thermal and electrical properties, Y3, Modelling, up to TRL 4

The future of the European nanotechnology industry is associated with a strong modelling and simulation capacity. Already the NMP.2013.1.1-4 call topic (Development of an integrated multi-scale modelling environment for nanomaterials and systems by design) outlined the overarching ambition to create an open, integrated and multi-purpose numerical nano-design environment to shorten the development process of nano-enabled products and to increase global competitiveness of our industries.
Projects under the present call have to collaborate with projects of the 2013 call and other nano-related modelling projects to further develop and augment the capacities of an integrated multi-scale modelling environment. A link to application specific data repositories and the overall harmonized development of new simulation modules is a key element in achieving the long term goal of a nano-design environment.
The present call focusses on the thermal conductivity enhancement of nanofluids. Increasing interest is being paid to nanofluids because of the intriguing heat and electric transfer enhancement performances presented by this kind of promising transfer media. Thermal conductivity enhancements of nano fluids could be influenced by a multitude of factors including the volume fraction of the dispersed nanoparticles, the tested temperature, the thermal conductivity of the base fluid, the size of the dispersed nanoparticles, the pretreatment process, and the additives of the fluids.
Projects should focus on selected challenges such as: Stability of the suspension, High interfacial thermal resistance, Large increases in the critical heat flux in boiling heat transfer. Furthermore, selected potential applications should be modelled where the thermal conductivity enhancements are the key enabler. A strong participation of highly specialized research centres is required.

## VALUE CHAIN 6: Integration of nano

### 19. Overall materials and product design system architecture. Unified methodologies for design of nano-enabled materials and products, Y2, Modelling, up to TRL level 5-6

Description to follow but based on the brief description in the roadmap, this would be a Coordination action, which probably overlaps significantly with the G3 CSA topic in the 2013 WP. Could also be postponed to Y3.

### 20. Unified methodologies for design of nano-enabled materials and products, Metrology, Y3, up to TRL level 5-6

Description to follow but essentially the topic is about nanometrology and standards for reproducibly measuring key operational characteristics of materials, structures, devices, facilitating also their simulation and design.

## VALUE CHAIN 7: Infrastructure for Multiscale Modelling and Testing

### 21. Development of a framework and data repository for integrating test data and calculated data for nano-materials and processes, Y1, Modelling, up to TRL 4

The main objective of the research should be to develop an online collaborative software framework linked to a validated data repository for connecting-together state of art materials simulation programs and test data, developed by researchers across Europe and all relevant experimental data from EU research. The framework will enable connection of codes that have never before been used in concert; validation of simulation codes using all available experimental data; development of case studies; improved testing of protocols and programs and sharing of test data. By focussing on connecting and integrating existing activities, rather than developing new simulation codes or testing programmes, the project will exploit the available resources and synergies and provide a substantial step forwards at low cost.
Note: the scope of this topic is at least partially overlapping with the WP 2013 topic on modelling. It may be appropriate to postpone this topic until Y3 and combine it with the design topic (no.22).

### 22. Multiscale and Multiphysics modelling and design technologies for a range of material systems and for various key problems, Y3, Modelling & design, up to TRL 4

The history of materials development has largely involved ad-hoc and serendipitous discoveries and inventions of new materials, with little systematic approach to the design process. This has generated some significant successes over the years, but also many cases of interesting new materials that were expensive to develop but never found an application – because their property profiles were not sufficiently superior to the incumbent materials in that application. Although substantial research effort has gone into numerical modelling of materials at all length scales – from quantum-mechanical to engineering scales, and there have been some modest attempts at bridging the length-scales using multi-scale approaches, there has been no systematic effort to develop true materials design tools that would enable materials scientists and engineers to tailor new materials to specific requirements, defined by the needs of new high-performance products.
This will require (i) new modelling methodologies for classes of materials and properties that have not previously been studied; (ii) substantially increased effort on bridging the length scales with computational methods, (iii) development of a set of new tools that guide the design process so that new materials development can be targeted precisely.

# Nano-enabled applications specifically targeting H2020 focus areas

## Personalising health and care

### 23. Multi-KETs pilot plant for the scale-up of innovative nanomedicine production; Y1, pilot line, up to TRL 8

Objective: To set up a European pilot plant for the evaluation of the scale up of innovative nanomedicine materials. This pilot should be developed in close proximity with their physical and chemical characterisation. The pilot plant will be developed for upscaling of promising
nanomedicines provided by SMEs, to help take them through the translation process, and to progress further in the value chain. This action will improve the availability of GMP nanomedicine materials for clinical trials and then on to the market. A close interface and association with the US Nanotechnology Characterisation Lab, where a similar initiative is under development, would be favorable.

### 24. Personalised health care by key enabling technologies: design and develop translatability of nanomedicine "from bench to bedside" by delivering personalized information for enhanced medical treatment, Y1, up to TRL 4 (6?)

Objective: To conceive, design, develop innovative nano-structures, devices and systems for the analysis and development of molecular information and dynamic progression of molecular profile for personalized medical treatment of various diseases (eg. cancer, neurodegenerative disease, Parkinson's, spinal lesion). This research aims at designing and developing, enhancing and improving innovative nano-enabled tools for enhanced personalized data harvesting, sharing, analysing, surveying and managing, processing the information at molecular level.

### 25. Nanomedicine therapy for cancer: from pre-clinical lab stage to early clinical testing, Y2, up to TRL 6

Objective: Translation of nanomedicine technology to be from pre-clinical lab stage to early clinical testing. The proposals should demonstrate a preclinical proof of concept, with relevant toxicity and efficacy data as well as a clear demonstration for industrial
translation, with a new drug for cancer patients in mind at all times.

### 26. Personalised health care and regenerative medicine by convergence of key enabling technologies to augment translatability of research "from bench to bedside": innovative engineering systems “of” and “for” the human body, prosthetic organs "by design", new human bionic machine/organ interfaces, Y2, up to TRL 4 (6?)

Objective: The proposed research should develop new concepts in cellular interactions with artificial man designed nanomaterials to provide innovative rules in the design of interfaces which can subsequently be applied to creating and integrating tissues in vivo, improving control of tissue development and tuning tissue performance.

### 27. Nanomedicine therapy for Altzheimer disease: from pre-clinical lab stage to early clinical testing, Y3, up to TRL 6

Objective: The topic description is similar to the cancer topic, since there is a high potential for Nanomedicine translation in Alzheimer's.

### 28. Development of novel industrial production processes for complex nano-pharmaceuticals, Y3, up to TRL 6

### 29. New strategies in guiding the design of next cell-instructive: exploiting properties and functionalities of nanostructured surfaces for innovative materials, systems and processes for tissue reconstruction, Y3

### 30. Application and use of convergence in nanotechnology, nanomaterials, nanoelectronics for "artificial organs by design" to provide affordable and viable artificial restoration of functions (eg. sight, ear, motor functions), Y3

## Smart cities technologies

### 31. Additive manufacturing for tabletop nanofactories, Y1, up to TRL level 6

### 32. Nanotechnology, e.g. nano-tagging, for easy recycling, reuse and renewal of materials, Y2, up to TRL level 6

Objective: To exploit progress in nano-sciences and to deploy nanotechnology in affordable, mass-produced nano-tagging systems for mass market applications for easy recycling, reuse and renewal of materials. This topic contributes to the smart cities technologies and communities; strengthening their self-sustaining capacity, reducing the need for land-fill sites and facilitates the urban production abilities in a local framework to reduce transport need

### 33. Green nanomaterials/processes for substitution of dangerous materials and processes, Y3, up to TRL level 6

Objective: To exploit progress in nano-sciences and to apply nanotechnology in affordable, green nanomaterials/processes for substitution of dangerous materials and processes for mass market applications within the concept for smart cities technologies and communities. To
substitute dangerous materials and processes from the materials sector used for transport systems, energy production/distribution and communication technology with green nanomaterials/processes will remove serious hazards as well as reduce the amount of source
material used.

## Competitive low-carbon energy

### 34. Efficient nano-enabled energy storage for industrial uptake, Y1, RDI up to TRL 6

### 35. Nanotechnology as an enabler for shortening the innovation chain of high efficiency and low cost solar energy conversion, Y2, RDI up to TRL 6

Objective: To optimise novel and emerging PV nanotechnologies, which are currently under development in on-going projects, in order to guarantee process reproducibility and reliability to reach higher Technological Readiness Levels (TRL) and lower cost to accelerate the integration of PV in society. Organic PV and thin films are not be addressed. Individual proposals shall address nanotechnology-based innovation in one of the following two baseline processes:

1. Innovative wafer-based silicon nanotechnology-based cells exploiting new materials and advanced cell architectures, such as heterojunctions, rear contact cells, metal wrap through, or other.
2. Innovative nanostructured cells based on novel active layers, innovative light management and innovative charge carrier extraction to ensure that the device is able to capture the highest amount of energy with the smallest amount of active semiconductor material

36. Nanotechnology as an enabler for breakthrough thermoelectric devices, Y3, RDI up to TRL 6

37. Development of bioreactors converting organic waste to electric power by bacteria connected to electrodes (microbial fuel cells running on organic waste and air), Y3, up to TRL 6-7

## Waste: a resource to recycle and reuse

38. Nanotechnology for detecting and monitoring of pollutants (environmental monitoring), Y1, RDI, up to TRL 6

39. Nanotechnology for reducing the release of industrial pollutants, including waste treatment, Y2, RDI, up to TRL 6

40. Nanotechnology for cleaning up polluted mining sites, Y3, RDI, up to TRL 6

## Water innovation: boosting its value for Europe

41. Low-energy filtration/separation processes for drinking water production, Y1, up to TRL 6-7

42. Economic processes for removing sub-ppb levels of priority water pollutants, Y3, up to TRL 4-5

Objective: Some priority water pollutants (e.g. endocryne disruptors) may still have undesirable health effects at levels below the current tresholds, either because the detection limits of the current analytical methods are not low enough, or because the current technologies do not allow. Technologies that might lower the order of magnitude of those thresholds need to be developed. This could, for example, be achieved through approaches based on molecular imprinting. Projects shall aim at demonstrating the technical and economic feasibility of lowering by one to two orders of magnitude the levels of selected endocryne disruptors in water and develop analytical methods with detection limits below the achievable levels.

# Cross-sectorial actions for responsible nanotechnology governance for societal and economic benefit

## Safety and contribution to regulation

43. Building a modelling and testing framework for nanomaterial release potential into the environment, Y1

44. High Throughput and Toxicity Pathway approaches as a basis for nanosafety assessment, nanomaterial grouping and read-across strategies, Y1

45. Modelling environmental transformation, transport and fate of nanomaterials, Y2

46. Keeping pace with innovations by enabling nanosafety; Development of next generation tools for risk governance of Nanomaterials, Y2

47. ERANET: SIINN II (or a Coordination action), Y2

48. Establishing advanced and realistic in vitro models for nanomaterial toxicity testing, Y3

49. “NANOREG” II: Next phase of research in support of regulation; jointly funded by EU and MS, Y1

50. Coordination of EU and international efforts in support of regulation (NANOREG EU and INT contributors), Y1, CSA

51. Defining and quantifying acceptable risk / Risk communication, Y2, CSA

52. Optimising realistic exposure conditions (dynamics and complexity) and risk assessment procedures in order to streamline regulatory testing for nanomaterials entering the European market, Y3

53. In support of the safety market: knowledge networks / transfer to industry / epidemiological cohorts / certification / training and skills / benchmarking / best practice, Y3, CSA

## Communication and outreach

54. 3-D visualization tools for enhanced communication, outreach and balanced information on nanotechnology, Y1, support action

In its aim at establishing sound and credible governance the European Commission is striving for a public debate in which balanced information is provided about benefits and risks and in which the citizens are able to express their views and concerns. However, recent surveys show that the awareness in the public about nanotechnology based products is very low and that awareness raising, without providing detailed information creates insecurity. In that respect, 3-D visualization tools are a key element for enhanced communication and improvement of societal understanding of nanotechnology. The targeted groups are youngsters, Civil Society Organizations, Media, and Lay Public.

On the one hand, 3D displays, augmented reality, and multisensory interfaces are accelerating the transformation of the human computer interaction. 3D graphics are key media in many sectors, and nowadays affordable consumer products using some of these technologies are

available. On the other hand a wealth of abstract data and imaging data has been collected in nano-related research projects, which is mostly not easily accessible for the wider public. The accessibility to the qualitative and quantitative understanding of such data by a larger public could be fostered by the use of 3D information visualization techniques. The major efforts of the project should be dedicated to the development of 3D content which is not only characterised by a geometry but also has attributes, semantics, and possibly interaction with time. The content should be built either from existing data (e.g. from finished or on-going FP7 projects) or from new data e.g. from modelling efforts on nano-toxicology phenomena. The projects should make use of commercially available technologies to create an interactive environment for the 3D information visualization. This can be a single user environment (e.g. immersion), but every project should also have a significant component where the environment can be experienced collectively (e.g. 3D projection techniques).

Projects should not focus on research on semantic multimedia or the development of

55. Identifying communication needs by developing a multi-stakeholders platform enhancing public engagement and establishing a societal dialogue towards responsible nanotechnology, involving Civil Society Organisations (CSOs), industry and policy-makers, Y2, support action

## Standardisation

56. Development of standardised methods for the characterisation of coatings and films at the nanoscale, and in particular for the measurement of porosity, thermal and magnetic properties at the nanoscale, Y1

57. Development of standardised methods for differentiating between nanoscale aggregates and agglomerates, for assessing their strengths, and for determining the fraction of aggregation and agglomeration, Y1

## Skills and education

58. Networking of SME's in the nano-biomedical sector for improving innovative potential; understanding translation, regulation, IPR, finance and reimbursement, Y1, Coordination Action

59. Promoting new skills for Scientific Social Responsibility to create new job opportunities through responsible innovation in nanotechnologies, Y2, support action

## Support for technology transfer and innovation financing

60. Identifying and promoting the business opportunities in research, Y1, support action or public procurement