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科技部　函

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第一層決行

受文者：國立暨南國際大學

發文日期：中華民國105年3月15日
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附件：

主旨：公開徵求「歐盟奈米材料科技於節能減碳及製程之應用」計畫書，請查照轉知。

說明：

一、本部協同28國41個補助機構同步公開徵求「歐盟奈米材料科技於節能減碳及製程之應用」計畫書，徵求主題如下：

(一)Integrated Computational Materials Engineering

(二)Innovative Surfaces, Coatings and Interfaces

(三)High Performance Synthetic and Biobased Composites

(四)Functional Materials

(五)Interfaces between Materials and Biological Hosts for Health Applications

(六)Materials for Additive Manufacturing

二、詳細申請辦法請查詢科技部網站「學術人士」計畫徵求公告之附件。

三、構想書(Pre-Proposal)統一透過歐洲線上系統提出申請，並將於本(105)年6月14日截止收件。

國際及兩岸事務處

裝　訂　線

105年3月15日收文總字第1050003524號

2996-6648

正本：專題研究計畫受補助單位
副本：電子公文交換章 2016-03-15 11:47:30

部長徐爵民

擬辦：
一、文登載校首頁公告周知。
二、影送科院。
三、有意申請者請參閱來文說明及附件。
四、文錄案續辦。

專案計畫助理 李鈺鳳 3/15

秘書室專門委員 徐朝堂 0321540

國立暨南國際大學校長 蘇玉龍(乙) 1050321

教授兼國際事務長 洪政欣

2/2

科技部 Ministry of Science and Technology

M-era.Net

歐盟計畫
跨國徵求奈米材料科技於節能減碳及製程之應用計畫書
(M-ERA.NET 2)

歐洲公告網址: https://www.m-era.net/
線上申請網址: https://www.m-era.net/
尋求歐洲合作夥伴網址: https://www.nmp-partnersearch.eu/

壹、 緣起

歐盟 Horizon 2020 **M-ERA.NET 2** 之「奈米材料科技於節能減碳及製程之應用」計畫乃歐盟研究總署協調及整合歐洲各國科研主管機關，共同投入研發經費之跨國「奈米材料科技於節能減碳及製程之應用」計畫。**M-ERA.NET 2** 計畫的參與國/機構共由 28 國 41 個 Funding Agency 所組成，各國之 Funding Agency 自行編列研究經費，補助自己國家的研究人員參與研究計畫，以利促成「奈米材料科技於節能減碳及製程之應用」跨國研究團隊之形成，避免各國資源重複投資並集各國家所長共同研究。

科技部參與歐盟 **M-ERA.NET 2** 計畫，與歐洲各國同步公開徵求計畫書，細節請參閱 **M-ERA.NET 2** 網站- https://www.m-era.net/)英文版之公告檔案，本次公開徵求之主題為:

一、	**Integrated Computational Materials Engineering**
二、	**Innovative Surfaces, Coatings and Interfaces**
三、	**High Performance Synthetic and Biobased Composites**
四、	**Functional Materials**
五、	**Interfaces between Materials and Biological Hosts for Health Applications**
六、	**Materials for Additive Manufacturing**

歐盟 **M-ERA.NET 2** 計畫參與之機構

Participant No.	Institute Name	Institute Short Name	Country
1	Austrian Research Promotion Agency	FFG	Austria
2	Federal Ministry For Transport, Innovation And Technology	BMVIT	Austria
3	Agency For Innovation By Science	IWT	Belgium

	And Technology		
4	Fund For Scientific Research	F.R.S.-FNRS	Belgium
5	Service Public De Wallonie – Direction Generale Operationnelle De l'Economie, De l'Emploi Et De La Recherche	SPW-DGo6	Belgium
6	Sao Paulo Research Foundation	FAPESP	Brazil
7	Research Promotion Foundation	RPF	Cyprus
8	Federal Ministry Of Education And Research / Bundesministerium Fur Bildung Und Forschung (BMBF)	BMBF	Germany
9	Forschungszentrum Juelich Gmbh, Projekttrager Juelich	FZJ-PTJ	Germany
10	Project Management Agency Karlsruhe (Ptka)	KIT-PTKA	Germany
11	Sihtasutus Eesti Teadusagentuur	ETAg	Estonia
12	Ministry Of Economy And Competitiveness	MINECO	Spain
13	Agency For Innovation And Development Of Andalusia. Agencia IDEA	AIDEA	Spain
14	Instituto De Desarrollo Economico Del Principado De Asturias	IDEPA	Spain
15	The Basque Innovation Agency	Innobasque	Spain
16	Agency Of Innovation, Business Financing And Internationalization Of Castilla Y Leon	ADE	Spain
17	Fundacion Para El Conocimiento Madrimasd	fmi+d	Spain
18	Limousin Region (Conseil Regional Du Limousin)	CRL	France
19	National Research, Development And Innovation Office	NKFIH	Hungary
20	Science Foundation Ireland	SFI	Ireland
21	Matimop, Israel Industry Center For Research & Development	ISERD	Israel
22	The Israeli Ministry Of Science Technology And Space	MOST	Israel
23	The Icelandic Centre For Research	RANNIS	Iceland
24	Ministry Of Education, University And Research	MIUR	Italy
25	Regione Calabria	REGCAL	Italy
26	Research Council Of Lithuania	RCL	Lithuania
27	Fonds National De La Recherche	FNR	Luxembourg
28	Valsts Izglitibas Attistibas	VIAA	Latvia

	Agentura – State Education Development Agency		
29	Materials Innovation Institute	M2i	Netherlands
30	Netherlands Organisation For Scientific Research	NWO	Netherlands
31	The Research Council Of Norway	RCN	Norway
32	National Centre For Research And Development	NCBR	Poland
33	National Science Centre	NCN	Poland
34	Fundacao Para A Ciencia E A Tecnologia	FCT	Portugal
35	The Executive Agency For Higher Education, Research, Development And Innovation Funding	UEFISCDI	Romania
36	Foundation For Assistance To Small Innovative Enterprises	FASIE	Russia
37	Ministrstvo Za Izobrazevanje, Znanost In Sport	MIZS	Slovenia
38	Slovak Academy Of Sciences	SAS	Slovakia
39	The Scientific And Technological Research Council Of Turkey (Turkiye Bilimsel Ve Teknolojik Arastirma Kurumu) Short	TUBITAK	TR
40	Ministry Of Science And Technology	MoST	Taiwan
41	Department Of Science And Technology	DST	South Africa

貳、 申請資格

一、公私立大專校院、公立研究機構。

二、經科技部認可之財團法人學術研究機構、醫療社團法人學術研究機構。

三、計畫主持人需符合「科技部補助專題研究計畫作業要點」規定。

四、**請詳閱本公告第捌點:「注意事項」**。

參、 補助經費

我國研究團隊依本次計畫徵求公告申請 **M-ERA.NET 2** 研究計畫並獲審查通過後，得向本部提出經費補助之申請，本部比照歐盟計畫方案辦理補助每件獲審查通過之 **M-ERA.NET 2** 研究計畫:

一、 補助上限：新台幣 300 萬元/年(分項)[1]。
二、 計畫期限：最多不超過 3 年。
三、 實際補助金額經科技部進行經費審查後核定。

註：本部設定參與歐盟 **M-ERA.NET 2** 計畫案補助金額上限時，皆假設國內專家學者有意申請歐盟跨國科技合作計畫者，於本部學術司已有類似主題或相關領域之專題研究計畫獲得科技部補助且執行中；或有類似相關計畫於國內獲得其他機關之補助。故本計畫案之補助金額主要乃因應參與歐盟跨國多邊型國際合作計畫所需新增之國際合作經費為主要考量。

肆、 補助項目

一、 國外差旅費(含移地研究費)。
二、 業務費：研究人力費(含專任助理、研究生或助理津貼、臨時工資等)、耗材、物品及雜項費用，及補助國外學者來台費用。
三、 管理費（上限 8%）。

伍、 計畫件數

一、 我方計畫主持人參與歐盟 **M-ERA.NET 2** 計畫得以 1 件計畫不列入科技部專題研究計畫件數計算，惟將列入本部「雙邊協議專案型國際合作研究計畫」計算。

二、 申請人目前主持 2 件本部「雙邊協議專案型國際合作研究計畫」，且其計畫執行日期均與本次徵求案之預定執行迄日重疊達 3 個月以上者，得不受理辦理補助。

陸、 申請方式及運作模式

一、 所有歐盟 **M-ERA.NET 2** 計畫參與國之 Funding Agency 同步於

[1] 此 **M-ERA.NET 2** 計畫目前規範單一研究計畫必須由 3 個團隊所組成，3 個團隊當中必須包含至少 2 個 **M-ERA.NET 2** 計畫參與國，且必須至少有 2 個 **M-ERA.NET 2** 計畫參與國是歐洲國家。但並未限制單一國家僅能有一個團隊參與一個研究計畫，故如我國有兩個團隊參與同一個計畫，如於該計畫中執行不同**分項**，則可各別向科技部申請補助新台幣 300 萬/年(上限)，或合併向科技部提出一整合型計畫，向科技部申請補助新台幣 600 萬/年(上限)，惟必須能夠清楚分辨出分項及工作內容的差異。

2016 年 3 月 15 日公開徵求第一階段的構想書(Pre-Proposal)，並將於 **2016 年 6 月 14 日**截止收件，每 1 件計畫必須由多國團隊(至少由 2 國及 3 個團隊)所組成，並委任 1 位擔任計畫主持人 Coordinator (我國亦可以擔任 Coordinator)，共同撰寫 1 份計畫申請書，並統一由計畫主持人 Coordinator 線上繳交送出申請。

M-ERA.NET 2 計畫線上申請系統網址如下，**有意申請計畫者請透過下列網址登入線上申請系統**。

網址: https://www.m-era.net/

二、 擬申請 **M-ERA.NET 2** 計畫者請自行尋求合作夥伴並組成團隊一起申請(Build Your Consortium)，或自行擔任 Coordinator 協調國外團隊或參與國外團隊的計畫皆可。

三、 擬申請計畫者請確認符合下列所有歐盟 **M-ERA.NET 2** 計畫所訂定之申請資格(Eligibility Criteria)及同時必須符合科技部的申請資格(例如: 必須是科技部受補助單位及所提經費不得超過科技部所設之上限等)。

四、 獲審查通過推薦之 **M-ERA.NET 2** 研究計畫，將由參與歐盟 **M-ERA.NET 2** 計畫之 Funding Agency 自行補助自己國家研究團隊所需之經費，我國之研究團隊/人員所申請或參與之計畫，如該計畫最後獲審查推薦者，則由科技部補助我國團隊所需之研究經費。

五、 1 件計畫只需線上提送 1 份計畫申請書(由多國團隊共同撰寫)，故如我國研究人員與歐洲研究人員共同組成 1 隊並由歐洲人員擔任計畫主持人(Coordinator)，則由歐洲計畫主持人(Coordinator)線上一併提出 Pre-Proposal，我方則配合計畫團隊所需提供計畫相關資料；如我國乃計畫之計畫主持人(Coordinator)，則必須協調歐洲團隊提供資料，並由我方於指定時間內線上提出申請。

六、 請依附件 Pre-Proposal 格式完成構想申請書，於 **2016 年 6 月 14 日前上傳**[2] **構想書(Pre-Proposal)至 M-ERA.NET 2 計畫線上申請系**

[2] 申請一律採線上作業，從公告內所指定之網站上繳交送出。

統；並以 Email 方式寄至自然司王心頎小姐。
(soa145@nsc.gov.tw)。

七、 受理申請之 **M-ERA.NET 2** 研究計畫將經2階段的審查: 分別為第1階段 Pre-Proposal 及第 2 階段 Final Proposal。第 1 階段 Pre-Proposal 是先由各 **M-ERA.NET 2** 計畫之參與國/機構所組成，按照 **M-ERA.NET 2** 之規範執行資格審查 (Eligibility Check)及初審，我國所申請或參與之 **M-ERA.NET 2** 計畫**則由科技部辦理資格審查及初審作業**，科技部將 2016 年 6 月 14 日 Pre-Proposal 截止收件後另擇日安排初審會議，邀請我國參與 **M-ERA.NET 2** 研究計畫之團隊及我國審查委員一起與會，並透過簡報方式向審查委員簡報計畫之內容及概要，並接受審查委員之諮詢**(面審)**。

八、 **M-ERA.NET 2** 計畫各參與國於執行初審結束後，將針對每一件自己國家所參與的計畫做出下列判斷:

(一)推薦該計畫進入第二階段並邀請該計畫撰寫 Full-Proposal。
(二)推薦該計畫進入第二階段惟必須納入審查委員之修正意見。
(三)不推薦該計畫進入第二階段(審查委員提供評語及說明)

九、 每件 **M-ERA.NET 2** 計畫必須由至少兩個 **M-ERA.NET 2** 計畫的參與國所組成，每一件 **M-ERA.NET 2** Pre-Proposal 必須獲得至少兩個參與國之 Funding Agency 推薦才能進入第二階段，並獲邀請撰寫 Final Proposal。如低於兩個 Funding Agency 推薦之 Pre-Proposal 則被視為未獲推薦。

十、 通過第一階段(Pre-Proposal)審查且獲推薦計畫之主持人將會獲得正式書信通知，並獲邀請計畫主持人於 **2016 年 11 月 10 日**前於指定的線上申請系統上繳交完整計畫書(Deadline for Submission of Full-Proposal)。

十一、 所有進入第二階段 Full-Proposal 之計畫，每件計畫將配予 3 位審查委員[3]，並指定其中一人作為該計畫之報告人，報告人必須彙整及評估3份書面審查結果並出席各國 Funding Agency 所辦理之 Full Proposal 審查會議中進行報告。

[3] 由各國所推薦之中立專家學者所組成。

十二、 所有進入第二階段 Full-Proposal 之計畫將在每件計畫之報告人與會討論後，綜整評估並針對所有 Full-Proposal 產出 1 份計畫優先推薦排序表。**M-ERA.NET 2** 計畫參與國之 Funding Agency 將討論並決定通過 Full Proposal 之件數(按照優先推薦的計畫排序表辦理以及各國可投入之經費而判斷)。

十三、 通過第二階段(Final Proposal)審查且獲推薦之 **M-ERA.NET 2** 研究計畫將於 **M-ERA.NET 2** 網站上公告，計畫主持人亦會收到正式書信通知，如我國所參與之研究計畫經第二階段(Final Proposal)審查後獲推薦者，經聯繫科技部承辦人後，可透過科技部線上專題研究計畫系統提出申請(隨到隨審)，並由科技部進行經費審查後核定補助經費。

十四、重要日期時間表

下表為 **M-ERA.NET 2** 委員會暫定之時間表，如執行期間有修正，將在 **M-ERA.NET 2** 網站上公告更新的時程。

Date	Activity
2016/3/15	**Launch of the Cofunded Call**
2016/6/14	**Deadline for Pre-Proposals**
2016/9/6	National/regional Pre-Proposal checks completed and available in IT system
2016/9/13	**Consensus meeting stage 1**
2016/9/16	Invitations for Full-Proposal phase
2016/11/10	**Deadline for Full-Proposals**
2016/11/20	evaluators get access to Full-Proposals -start of central evaluation of Full-Proposals
2016/12/20	Deadline for compilation of individual assessments
2017/1/10	Deadline for compilation of consensus reports (online discussions/panel meeting and peer review report finished)
2017/1/24	**Selection meeting of programme owners - adoption of ranking list**
2017/2/8	Start National/Regional contract preparation
2017/5/19	Start transnational RTD projects

柒、本次歐盟 **M-ERA.NET 2** 公開徵求計畫之 6 大主題:

Topic 1: Integrated computational materials engineering (ICME)

Technical content/scope

Current developments in combinatorial synthesis and multi-scale modelling together with high throughput or multi-scale experimentation allow for a faster development of materials targeted to both enhanced performance and processability. A skilful combination of these approaches in terms of Integrated Computational Materials Engineering will lead to significant improvements in our ability to design new materials or to assess materials performance already in the product development stage.

The proposals should focus on either of the following model-driven schemes:

a) Design of new materials with properties targeted for engineering applications, *or*

b) Tailoring microstructural changes of known materials to obtain new or improved properties,

or

c) Creating or improving tools to advance virtual design, virtual testing or virtual processing.

Objectives: The proposals should address each of the following items:

1) **Constitutive modelling and computational simulation:** Use of materials physics-based design principles in a computational environment, bridging the gap
between different time and size scales

2) **Target properties:** Definition of specific goals to be reached, by defining criteria. For schemes a) and b) the criteria need to be quantitative target properties.

3) **Experimental Validation (including Calibration) across multiple length scales**.

The proposals should clearly present the approach taken for relating these three items.

Expected impact

The proposal should address how it will contribute to the expected impact of the topic :

- Improved predictive power of Integrated Computational Materials Engineering.
- Establishment of well-targeted materials design and processing concepts.
- Building and strengthening a common European research community in the area of Integrated Computational Materials Engineering.

- Increased competitiveness of the European industry by cost saving in materials design and processing and a shortened time-to-market for materials with advanced properties
- Emphasize any potential advances in energy storage, generation or savings in the applications areas for the new materials/processes/properties obtained through ICME
- Proposals should clearly demonstrate credible benefits in engineering applications areas for the materials/processes/properties developed through ICME
- Projects within this topic could be basic or applied research (TRL target for project deliverables within levels 2-5)
- All proposals should clearly state and motivate at what level on the Technology Readiness Level (TRL) scale the project is situated at the beginning and after the project is finished (see Annex 2). In order to increase the potential for new business opportunities and commercial exploitation of the results, proposals aiming at TRL below 4 should include a plan for the transition to higher TRL's at a later stage (i.e. beyond the project end date) and demonstrate industrial involvement. This can be realised by establishing an industrial advisory board (or alternatively by the participation of one or more companies in the project consortium when feasible). For proposals aiming at TRL above 4, industrial partners should be involved in the project consortium.

Target groups

This topic is targeted to two steps in the innovation chain: basic research and applied research. Project consortia focusing only on basic research or only on applied research are also eligible. The establishment of a strong collaboration between research entities and further networking is strongly encouraged.

Keywords

ICME, constitutive modelling, computational simulation, experimental validation, multiple length scales.

Topic 2: Innovative surfaces, coatings and interfaces

Technical content/scope

Surface and coating technology is a key enabler for new solutions in numerous industrial sectors in Europe. This call will stimulate application driven development of innovative, multifunctional coatings and related processes.

The target properties addressed in this call include but are not limited to : tribology, chemical and corrosion resistance, optical, electromagnetic, (anti-) adhesive, electro-catalytic characteristics, active and responding coatings, long term performance, multifunctionality and coatings for severe environmental conditions. In particular, energy related coating properties are encouraged to be addressed in the sector of wind, PV, concentrated solar cells (CSC), geothermal energy, bioenergy, fossil fuel energies,

nuclear energy, energy efficient materials (EEM) for buildings and energy storage. The proposals should also consider the processing aspect of the new technology aiming for flexible and energy-efficient approaches in production with smart use of materials (saving resources and tailoring applications) in an environmentally friendly manner.

Objectives

The objective of the call is to develop innovative or significantly improved coatings, interfaces and process solutions by chemical and/or physical surface modification. This call aims to generate new insights in surface modification, manufacturing, and tailoring of (multi-) functional coatings by a holistic understanding of the relationship of materials – processes – applications. This will enable a new generation of engineered surfaces with improved and combined characteristics.

The project proposals should address innovative surface modification and coating solutions, consider innovative processing routes or new concepts for coating and surface treatment.

Project proposals should also focus on one or several of the following points: interdisciplinary process combinations, innovative surfaces and coating materials, material compounds, nanomaterials, surfaces with sensor capabilities, structured surfaces, composite coatings or multilayers. Consideration should be given to basic understanding of the mechanisms, experimental assessment, prototyping, up-scaling, manufacturing and/or validation.

In order to ensure relevance for different partners in the value chain, the proposal should state clear concepts for application(s) and industrial sector(s).

Expected impact

- Innovative components/products with tailored properties or functionalities by tuned surfaces and coatings.
- A positive ecological and energetical impact in terms of avoidance of hazardous materials and compounds and aspects of sustainability in processes, coating material, technology and product life cycles is expected.
- The project should address innovative products or technologies based on functionalised surfaces and coatings that might have strong societal impact, on e.g. safety, economics, employment and life quality, and are expected to create synergies between industry and research.
- The project should include partners all throughout the value chain, even proposals focused on basic research should give a strategy for transfer to industry including a roadmap of valorisation with a strong emphasis on IPR protection.
- The transnational and/or international exchange of researchers from RTD entities and industrial partners is encouraged.

- All proposals should clearly state and motivate at what level on the Technology Readiness Level (TRL) scale the project is situated at the beginning and after the project is finished (see Annex 2). In order to increase the potential for new business opportunities and commercial exploitation of the results, proposals aiming at TRL below 4 should include a plan for the transition to higher TRL's at a later stage (i.e. beyond the project end date) and demonstrate industrial involvement. This can be realised by establishing an industrial advisory board (or alternatively by the participation of one or more companies in the project consortium when feasible). For proposals aiming at TRL above 4, industrial partners should be involved in the project consortium.

Target groups

This topic is targeted to all groups in the innovation chain: basic research, applied research and industrial R&D. The particular subject of the proposal deals with the establishment of a strong collaboration between research entities and SMEs.

Interdisciplinary projects are encouraged and should enable a broader cross-sectorial use. Participation of large industry is encouraged e.g. as potential end user of the technology proposed.

Keywords

Functionalised surfaces, (multi)functional coatings, understanding relationships between materials – processes – and applications.

Topic 3: High performance synthetic and biobased composites

Technical content/scope

Within the scope of this call, composites are defined as engineered materials, including hybrids, composed of two or more constituents – typically a polymer matrix and a reinforcement being in the form of a fibre or a filler - to meet the requirements which cannot be otherwise fulfilled by one component alone. The matrix and/or fibres/fillers can be synthetic or biobased. With biobased materials it is meant materials obtained from renewable, biological resources.

Objectives

The call aims basically at composites having adequate functional properties for the target applications including mechanical performance like high strength or stiffness to weight ratio and physical-chemical properties like thermal and electrical conductivity. The research proposals could also address methodology and tools for design-optimisation, manufacturing, automation, process and structural health monitoring, modelling and simulation of processing as well as in-service behaviour of composites. The possible application areas may include among others energy applications (consumption reduction,

storage and production), light weight structures in transportation, mobility, and other engineering applications.

The research proposals should address one or more of the following:

- New material designs based on defined structure/property relationships, enabling substantial improvement of the mechanical performance.
- Development of new biobased resins, biobased fibres/fillers, biobased composites with natural fibre reinforcement, and fully biobased composites.
- New composites which combine improved mechanical performance with other physical or physical-chemical functionalities This could be achieved among others by the integration of nanophases into the material.
- Composite processing methods enabling high production rates, aiming at applications in high-volume markets. Material innovations could encompass fast curing, low viscosity resins or stampable thermoplastic composite sheets, but also automation, robotisation and energy optimisation of the production process should be envisaged.
- Composite processing technologies for joining, assembling and repair, which also reduce after-work.
- Composite end-of-life technologies.
- Novel and unique knowledge in molecular design, functionalization and characterization of a wide range of fibre or filler reinforced composite materials.
- Modelling and simulation of processing conditions and in service behaviour of composites using a multiscale approach.
- Composites with improved reinforcement/matrix interaction.

To strengthen the whole innovation chain it is strongly recommended that the project proposal is balanced by incorporating materials, processing and application development of composites. Such integration could be further enhanced by fostering collaboration between universities and industry, and by a consortium covering the whole value chain.

Expected impact

- More competitive industrial products and processes using the advanced materials design and manufacturing concepts.
- Socio-ecological benefits provided by products with higher integration level of functionality, lighter products to transport, lighter dynamic applications to decrease energy consumption, and by using materials with lower environmental impact.
- Because the composites industry is characterised by a large number of scattered players, including SME manufacturers and equipment suppliers, the projects should result in networks inside Europe, thereby improving the sharing of knowledge and reinforcing both technological and scientific platforms.
- All proposals should clearly state and motivate at what level on the Technology Readiness Level (TRL) scale the project is situated at the beginning and after the project is finished (see Annex 2). In order to increase the potential for new business opportunities and commercial exploitation of the results, proposals aiming at TRL below 4 should include a plan for the transition to higher TRL's at a later stage (i.e. beyond the project end date) and demonstrate industrial involvement. This can be realised by establishing an industrial advisory board

(or alternatively by the participation of one or more companies in the project consortium when feasible). For proposals aiming at TRL above 4, industrial partners should be involved in the project consortium.

Target groups
This topic is targeted to all groups in the innovation chain: basic research, applied research, industrial R&D. The particular subject of the proposal deals with the establishment of a strong collaboration between research entities, SMEs and large industry.

Keywords
Composites (synthetic, biobased), hybrid material systems, functional properties, in-service behaviour, design methodology, process technology

Topic 4: Functional materials

Technical content/scope
Advanced functional materials are, and should remain, an important economic and employment generator in Europe. Multifunctional materials, as opposed to structural materials, are the bottleneck for almost all technologies. Designing of materials and microstructures with tailored properties is needed to achieve high performance in industrial applications, especially when considering long term stability. Special attention must be paid to the requirements for application conditions referred to energy technologies.

Currently over 80 % of Europe's energy use is based on oil, gas and coal. The European Strategic Energy Technology Plan (SET Plan) recognises this situation and emphasises the growing need for cost-competitive low carbon energy and energy efficiency technologies. The SET Plan Materials Road Map emphasises the pivotal enabling role of advanced materials and clearly outlines the medium to long term strategy for the coming years.

Objectives
The scope of this call is to develop advanced functional materials, or material systems with improved physical, chemical and mechanical properties leading to advances on the following topics:

1. Multifunctional, nano/microstructured materials with properties tailored to perform function on demand:
    1) Materials that can integrate several functions into structures, such as electromagnetism, thermal management, optics capability
    2) Smart materials that enable sensing, actuation, energy storage, structure

2. Production of fuels
    1) Production of hydrogen and hydrocarbon fuels: photocatalytic water splitting, (co-)electrolysis

2) Bioenergy (biogas, biofuels)
3) Advanced materials for separation, purification, affordable implementation of carbon capture/separation, materials for the storage or utilisation of CO2

3. Power generation
   1) Materials for fuel cells (catalysts, electrodes, etc.)
   2) Wind energy (materials for generators, such as permanent magnets)
   3) Solar energy generation (for example: materials for photovoltaics, concentrated solar power and concentrated photovoltaics)
   4) Functional materials under extreme conditions in power generation plants (nuclear, concentrated solar power, geothermal energy, IGCC plants)

4. Energy storage
   1) Hydrogen storage
   2) Electrochemical storage (ionic and electronic conductors for new electrochemical concepts, supercapacitors)
   3) Thermal storage such as molten salts and eutectic alloys

5. Efficient use of energy

- Energy efficiency in residential and commercial buildings (for example: advanced insulation materials, materials for high efficiency / high brightness lighting (LEDs / OLEDs)...)
- Energy efficiency in energy intensive industrial sectors such as chemicals, cement, glass, non-ferrous metallurgy, pulp and paper, etc. (for example advanced insulation or heat exchanger under harsh environment, materials for high power electronics in converters, thermoelectric conversion ...)

The research proposals should give sufficient attention to mid- or long term industrial feasibility, reliability, durability and life cycle analysis (LCA) including cost analysis (LCC) and environmental compatibility. The materials development should aim to a clear and quantified improvement in performance, cost reduction and sustainability towards critical raw materials use. Proposals should include some quantitative appraisal on the expected greenhouse gas emissions savings (including CO_2, methane, nitrous oxide and F-gases).
A proposal must consider, demonstrate and clarify its added value and impact, and where appropriate, its alignment with the SET Plan materials Roadmap. For basic research programmes (lower TRL), radically new concepts should be proposed and demonstrated with respect to the state of the art.
In case the research proposal intends to make use of critical and potentially scarce raw materials – see critical raw materials for EU2 - the applicants are requested to present a justification for this choice. Projects may also address substitution or recycling of such critical or scarce materials.

Expected impact

- Ensure the future European energy supply through technological development

based on novel multifunctional materials

- Support the European strategic policy targets in terms of greenhouse gas emission reduction and developing affordable sustainable energy sources and usage.
- Improved competitiveness and strengthened industrial leadership.
- Strengthened innovation excellence of the European academia and research institutes.
- All proposals should clearly state and motivate at what level on the Technology Readiness Level (TRL) scale the project is situated at the beginning and after the project is finished (see Annex 2). In order to increase the potential for new business opportunities and commercial exploitation of the results, proposals aiming at TRL below 4 should include a plan for the transition to higher TRL's at a later stage (i.e. beyond the project end date) and demonstrate industrial involvement. This can be realised by establishing an industrial advisory board (or alternatively by the participation of one or more companies in the project consortium when feasible). For proposals aiming at TRL above 4, industrial partners should be involved in the project consortium.

Target groups

This topic is targeted to all groups in the innovation chain: basic research, applied research, industrial R&D. The particular subject of the proposal deals with the establishment of a strong collaboration between research entities, SMEs and large industry. Consortia focusing only on basic research or industrial R&D are also eligible.

Keywords

Advanced functional or multifunctional materials, improved properties (physical, chemical and mechanical), nano/microstructured materials.

Topic 5: Interfaces between materials and biological hosts for health applications

Technical content/scope

Wellness and healthy ageing of the European population will require new or improved solutions to health-related issues. Many of these solutions will come from the development of new advanced materials as key components of diagnostics (contrast agents, implantable devices) and therapeutics products (drug delivery systems, implants, tissue regeneration strategies, cell and gene therapies, etc.). These materials will necessary be in contact with the human body at different levels.

The purpose of this call topic is to provide opportunities to advance material-based technologies closer to the market. This action is aligned with societal challenge regarding "Health, Demographic Change and Wellbeing" as defined in the H2020 framework. It is also in agreement with the recognition of advanced materials as a Key Enabling Technology for strengthening the competitiveness of the European industry.

Objectives

The main objective is to obtain a better understanding of the interfaces between biomaterials (non-biological) and its biological hosts (e.g. organs, body tissues, cells and human bio-fluids). Materials investigated should target at least one clinically relevant application.

Proposals may address one or more of the following;

- Interactions between biomaterials and biological species with specific focus on multiple length and/or time scales.
- Aspects such as biofilm formation and biodegradation,
- The crossing of biological barriers such as blood brain barrier, digestive system, skin barrier, or cell membranes
- Understanding of the impact of the sterilisation process on bio/materials interfaces.

Successful proposals are expected to take into account the following:

The potential market and exploitation routes of the understanding that would lead to technical solutions should be outlined. A report on relevant regulatory issues should be provided. If applicable, adequate consideration should be given to the scale-up of the proposed technological solutions and to the possible industrialisation towards a final product.

Moreover, the proposals are strongly encouraged to consider the following issues:

- Where appropriate the *in vitro* testing and/or assays in small animals should be conducted following the bio-ethical committee rules of each centre.
- Cross collaboration between materials scientists, biologists, medical doctors and industrial partners.
- International collaborations with leading research entities from M-ERA.NET associated countries.
- Involvement of SMEs and/or industrial partners.

Expected impact

- Understanding the complexity of bio/materials interfaces at multiple spatial and/or time scales going far beyond the current state of the art.
- Achievement of new or improved materials' performance for health.
- Higher competitiveness of the European health industry through more reliable products and processes.
- Improved market access through increased awareness of the regulatory protocols. Increased collaborations between materials science RTD performers, industrial and medical stakeholders in the health sector.
- At the end of the project the technology being addressed is expected to reach TRL 5 (see Annex 2).
- All proposals should clearly state and motivate at what level on the Technology Readiness Level (TRL) scale the project is situated at the beginning and after the project is finished (see Annex 2). In order to increase the potential for new business opportunities and commercial exploitation of the results, proposals aiming at TRL below 4 should include a plan for the transition to higher TRL's

at a later stage (i.e. beyond the project end date) and demonstrate industrial involvement. This can be realised by establishing an industrial advisory board (or alternatively by the participation of one or more companies in the project consortium when feasible). For proposals aiming at TRL above 4, industrial partners should be involved in the project consortium.

Target group
This topic is targeted to all groups in the innovation chain: basic research, applied research, industrial R&D. Collaboration between research entities, SMEs and large industry is encouraged.

Keywords: Biomaterials, bio-interfaces, biofilms, biodegradation, nanotechnology, nanomaterials for biomedicine, implants, scaffolds, cell membrane,

Topic 6: Materials for additive manufacturing

Technical content/scope
Additive Manufacturing (AM) is a process of building 3D parts and components directly based on a digital model usually by adding material layer by layer. AM is a rapidly developing industrial sector and, potentially, a disruptive one not least because, in principle, it has the potential to be material and energy effective and sustainable compared to subtractive technologies. However, the potential to fully exploit 3D AM processes is currently limited due to the limitations of the available materials' sets. While past developments have focused mainly on polymers and metal alloys, there exist big opportunities related to ceramics and composites. Within this call, the driving force for materials development should come from specific potential applications that will arise from improved performance, reliability and economics of manufactured components.

Objectives
The objective is to develop innovative metallic, ceramic and polymeric materials designed for use in AM processes and advanced production systems in order to confer improved or modified properties for the manufacturing of components. The main focus of this call lies in the development of materials specifically designed for use in AM processes (e.g. tuning composition, structure, morphology, powder processing parameters etc.). The final goal of proposed projects should be to demonstrate the ability of new materials and processes to achieve finished components exhibiting improved performance, preferably with reduced life cycle costs.

Project proposals should address developments in e.g. mechanical and corrosion properties, surface finishing, internal stress reduction, electrical and thermal conductivity, and materials specifically designed to exploit the potential of AM systems to produce reliably functionally graded and composites components. Focus should be on materials for and production processes for final part production. Proposals should aim to emphasise energy related aspects of the research.

Examples of proposals that would be considered eligible under this call include, but are not exclusively confined to:

- Development of materials and processes designed to overcome problems relating to internal stress in AM parts.
- Development of materials for the AM production of components for use in extreme environments.
- Materials for use in the production of improved scaffolds used in regenerative medicine applications.
- Development of novel materials and processes to enable innovative applications for AM parts.
- New materials for energy efficient heat exchangers with complex geometry.

Expected impact

- Development of materials for the production of reliable AM parts/components suitable for specific application classes.
- New feedstock materials (e.g. powder, wire, filament) specifically developed to enhance functionality, reliability and performance
- New process technology adapted to the production of new feedstock materials.
- Projects within this call could be basic or applied research (TRL target for project deliverables within levels 3-6)
- Project consortia should involve companies having the ability to industrialise the results
- The use of living biological materials as part of the AM process is not covered by this call
- All proposals should address any environmental, social or ethical impacts where relevant
- All proposals should clearly state and motivate at what level on the Technology Readiness Level (TRL) scale the project is situated at the beginning and after the project is finished (see Annex 2). In order to increase the potential for new business opportunities and commercial exploitation of the results, proposals aiming at TRL below 4 should include a plan for the transition to higher TRL's at a later stage (i.e. beyond the project end date) and demonstrate industrial involvement. This can be realised by establishing an industrial advisory board (or alternatively by the participation of one or more companies in the project consortium when feasible). For proposals aiming at TRL above 4, industrial partners should be involved in the project consortium.

Main target groups

This topic is targeted at all groups in the innovation chain: basic research, applied research, industrial R&D. Collaboration between research entities, SMEs and large industry is encouraged as is participation in project consortia by international organisations.

Keywords

Materials development; 3D printing; Additive Manufacturing; Component properties;

Production; Polymers; Metals; Ceramics; Application driven; Life cycle cost; Materials efficiency

捌、注意事項

一、 每件計畫必須由**最少 3 個團隊，並從至少 2 個 M-ERA.NET 2 計畫參與國所組成**，且必須至少有 2 個 **M-ERA.NET 2** 計畫參與國是歐洲國家，並未限制 **M-ERA.NET 2** 計畫參與國僅能出一個團隊參與一件計畫，單一研究計畫的執行期限最多不得超過 3 年。

二、 每件 **M-ERA.NET 2 研究**計畫不可包含 **M-ERA.NET 2 計畫**參與國之外的團隊參加。如研究計畫內包含非 **M-ERA.NET 2 計畫**參與國則視為不符合資格審查，將不受理。

三、 每件 **M-ERA.NET 2** 研究計畫必須有 1 位計畫主持人(Coordinator)，且計畫主持人必須由 **M-ERA.NET 2** 計畫參與國家中的團隊擔任，我國亦可擔任 **M-ERA.NET 2** 研究計畫之計畫主持人(Coordinator)。

四、 歐盟 **M-ERA.NET 2** 計畫審查將針對每一個審查要點採分數(最高 5 分)制辦理，次審查要點(Sub-Criteria)容許採用 0.1 分制以區隔每件計畫的差異。每一個審查要點不得低於 3 分，且彙整三個審查要點分數之總和不得低於 10 分。

Main Criteria	Sub Criteria
Excellence	▪ Clarity and pertinence of the objectives ▪ Credibility of the Proposed approach ▪ Soundness of the concept, including trans-disciplinary considerations, where relevant ▪ Extent that proposed work in ambitious, has innovation potential, and is beyond the state of art (e.g., ground-breaking objectives, novel concepts and approaches
Impact	▪ Contribution at the European or international level to the expected impacts listed in the work programme under the relevant topic ▪ Enhancing innovation capacity and integration of new knowledge ▪ Strengthening the competitiveness and growth of companies by developing innovations meeting the needs of European and global markets ▪ Any other environmental and socially important impacts (not already covered above)

	▪ Effectiveness of the proposed measures to exploit and disseminate the project results (including management of IPR), to communicate the project, and to manage research data where relevant
Quality and efficiency of the implementation	▪ Appropriateness of the management structures and procedures ▪ Quality and relevant experience of the individual participants ▪ Quality of the consortium as a whole (including complementarity balance) ▪ Appropriate allocation and justification of the resources to be committed (budget, staff, equipment)

五、 通過審查且獲得補助之計畫團隊必須簽署團隊協議(Consortium Agreement)

六、 每件獲推薦且補助之 **M-ERA.NET 2** 研究計畫，計畫主持人必須繳交期中報告及期末報告。所有報告必須用英文撰寫，不同國家之計畫成員必須配合計畫主持人(Project Coordinator)之協調繳交英文版之研究分項執行資料。

七、 本部核定通過之 **M-ERA.NET 2** 研究計畫，請依本部專題研究計畫相關規定繳交研究成果及結案報告(建議用英文書寫，因為 **M-ERA.NET 2** 研究計畫團隊會向計畫成員索取 1 份)。本部亦得請我國計畫主持人至本部指定場合口頭報告，或配合本部辦理實地考評審查。

八、 本徵求公告未盡事宜，應依「科技部補助專題研究計畫作業要點」、「科技部補助專題研究計畫經費處理原則」及其他相關規定辦理。

九、 申請本計畫無申覆機制，一切依照歐盟制定之審查機制及各國公認的程序及方式辦理(與所有參與 **M-ERA.NET 2** 計畫會員國適用相同標準)。

玖、承辦人

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