# Press Conference President of JST

September 19, 2013

Japan Science and Technology Agency

### Chronology of research on the field of nanotechnology and materials at JST (CREST and PRESTO)



01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
	Virtu area	al labor s of JST	atories l's nanc	in vario technol	ous logy									
	CREST: 9 areas PRESTO: 1 area				CREST Develop PREST	O: oment of t O: Structu	he founda ires and C	ation for n Control of	ano-inter interfaces	face techi s (2006-20	nology 011)			
					CREST: Establishment of innovative manufacturing technology based on nanoscience PRESTO: Search for Nanomanufacturing Technology and Its Development (2006-2011)									
						CREST: Creation of Nanosystems with Novel Function through Proc CREST: Development of high-performance nanostructures for proce PRESTO:								
							Nanosys	stems and	Emergent	Functions	1			
CREST: Cr	REST: Creation of Innovative Functions of Intelligent Materials on the Basis of Element Strategy PRESTO: New Materials Science and Element Strategy									L	Until fiscal 2017			
	CRE	ST: Estat	blishment	of Molecu PREST	ılar Techr O: Moleci	ology tov ular techn	vards the ology and	Creation of the creation of the creation	of New Fu of new fu	nctions nctions		ι	Intil fisc	al 2019
CRES	ST: Creati	on of Inno	vative Fu	nctional M PR	Materials v ESTO: Hy	vith Adva per-nano·	nced Prop space de	perties by sign towa	Hyper-na rd innova	no-space tive funct	Design ionality	ι	Jntil fiso	al 2020

#### Design and application technology of nano-space-and-gap-controlled materials



Superconductivity

lon

conduction

### What are space-and-gap-controlled materials? They are the materials with new functions, which are not realizable in

bulk materials, developed by controlling the shape, size, dimension, and configuration of the "spaces" linking the elements of the materials in nano-micrometer. The development of the revolutionary functional materials follows the consideration of their structure, functions, and interactions and assembly of all of them. Space-and-gap-controlled materials express the functions of separation, absorption, catalyst, storage, ion conduction, and energy conversion.

Most functions and properties are determined by the structure of elements (crystal system or amorphous).



Strengths in the fields of environment, resources, and energy

"Expression of innovative, cutting-edge functions that are not realizable in bulk materials"

**Electric heat** 

conversion

Storage

Catalyst



nano-scale

Progress in nanotechnology renders the control of nano-space-and-gap materials practical!

Control of "spaces" on a

Strategies for offsetting the element strategy

- Conversion of energy: Photoelectricity, electrochemistry, electric heat, and friction
- Superconductivity: Electronics, power storage, and power transmission
- Storage of materials: Catalyst, absorption, capture, transportation, and electrode materials
- Reagency and synthesis: Catalyst (MOF) and reactive sites
- Structural materials: Lightweight, high mechanical strength, high durability, and insulation
- Separation: Technology for separation and absorption of rare metal and gas



## Space and Gap – from establishment of strategic objects to selection of research areas



Center for Research and Development Strategy (CRDS), Japan Science and Technology Agency
In July 2008, studied at the CRDS workshop
In December 2009, studied at the CRDS workshop
In March 2012, studied at the CRDS workshop
 Ministry of Education, Culture, Sports, Science and Technology
In July 2011, studied at the Nanotechnology and material science technology committee
 Council for Science and Technology Policy
In November 2012, in the CSTP's working group, dealt with space-and-gap-controlled
materials as part of a technology area to be enhanced in the future

### **Strategic Objects in Fiscal 2013**

Creation of new functional materials by means of technology for controlling spaces and gaps in advanced materials in order to realize selective material storage, transport, chemical separation, conversion, etc.



"Creation of Innovative Functional Materials with Advanced Properties by Hyper-nanospace Design" (Research Supervisor: Tohru Setoyama)

"Hyper-nano-space design toward innovative functionality" (Research Supervisor: Kazuyuki Kuroda )

# JST's enthusiasm for R&D of nanotechnology and materials



### Produce research outcomes resulting from the concepts generated in Japan

- > Creation of fields and innovations that always draw world attention
- Strategies": Why are we involved in this R&D as a nation?
- The idea of "researchers assembling for the purpose of creating a new society"
  - $\rightarrow$  Platforms for "the art of design and manufacturing (*monozukuri*)"

### $\square \ \textbf{Assemble} \rightarrow \textbf{integration and collaboration with different fields}$

Harmonize visions (views of history, world, society, or substance), R&D systems (ecosystems constructed of platforms and networks), and globalization

### Revise concepts in collaboration with academic circles and researchers' communities

### **D** Excellent outcomes generate a new strategy: PDCA Cycle