PI-KEM

THIN FILM + NANO RESEARCH

Product Overview

A BOND WORTH FORMING

WE ENABLE INNOVATION

For over 30 years we've been enabling you to accelerate your research and development, proudly partnering with the most innovative minds in the science and technology sectors.

We're purpose designed to support your science and technology innovation, and take your ideas from lab-based concepts to full-scale production.

With our capabilities and extensive expertise we're the partner of choice for custom manufacturing solutions and niche product sourcing through our trusted network of UK and international suppliers.

Our PI-KEM Clusters of specialist product groupings:

- **Energy Research**
- **Hydrogen Technology**
- **Photonics + Optoelectronics**
- **Thin Films + Nanotech**
- **Materials Processing + Analysis**
- **RF Shielding**
- **Electroforming**
- **Specialist Metallic Coatings**

Accelerate your journey. **We are PI-KEM.**

MICRO-INFO

- 30+ years supplying advanced materials and equipment
- Custom manufactured components
- Niche product sourcing
- Comprehensive range of standard stock products and consumables
- Call off purchase options
- Support from an expert scientific team
- Low minimum order quantity
- UK, European & global delivery

We offer a wide range of advanced materials and equipment which are available as standard or custom manufacture.

Within this catalogue are our most requested lines, however we welcome any enquiry for other specifications.

CONTENTS

Thin Film & Nano Research

Our Partners

We distribute on behalf of leading manufacturers of advanced materials & equipment

SINGLE CRYSTALS + SUBSTRATES

We offer a wide range of single crystals and substrates, which are available as standard or custom manufacture.

Below are our most requested lines, however we welcome any enquiry for other specifications including purity, dopant or custom melts.

Single Crystal	Oxides	Other forms
Aluminium (Al)	Aluminium Oxide (Sapphire) *Available in all orientations*	
Barium (Ba)	Barium Oxide	Barium Fluoride, Barium Titanate
Calcium (Ca)	Calcium Oxide	Calcium Fluoride, Calcium Neodymium Aluminate, Calcium Titanate
Chromium (Cr)	Chromium Oxide	
Copper (Cu)		
Gallium (Ga)	Gallium Oxide	Gallium Gadolinium Garnet (GGG) / SGGG
Germanium (Ge)		
Gold (Au)		
Iron (Fe)	Iron Oxide (Fe_2O_3, Fe_3O_4)	
Lanthanum (La)		Lanthanum Aluminate
Lithium (Li)		Lithium Fluoride, Lithium Niobate (Pure or Doped), Lithium Tantalate
Magnesium (Mg)	Magnesium Oxide (Pure or Doped)	Magnesium Fluoride, $MgAl_2O_4$ (Spinel)
Neodymium (Nd)		Neodymium Gallate
Nickel (Ni)	Nickel Oxide	
Silicon (Si)	Silicon Dioxide (Quartz)	Platinised Silicon
Silver (Ag)		
Sodium (Na)		Sodium Chloride
Strontium (Sr)	Strontium Oxide	Strontium Lanthanum Aluminate, Strontium Lanthanum Gallate, Strontium Lanthanum Titanate
Tin (Sn)	Tin Oxide (SnO2)	
Titanium (Ti)	Titanium Dioxide (Rutile/Anantase)	
Yttria (Y_2O_3)		Yttria Zirconia (YSZ)
Yttrium (Y)		Yttrium Aluminium Garnet (YAG), Yttrium Indium Garnet (YIG)
Zinc (Zn)	Zinc Oxide	Zinc Selenide, Zinc Sulphide

WAFERS

We provide an extensive choice of wafers.

Below are our most requested lines, however we welcome any enquiry for other specifications.

Glass Wafers

The following specifications of Borofloat glass wafers are all available from stock for immediate despatch.

We also offer wafers and tiles to custom specifications, including diameter, thickness and polish.

Material	Wafer Diameter	Thickness	Polish
Borofloat BF33 Glass	2” (50.8mm)	0.5mm ± 0.025mm	Double Sided Polished
Borofloat BF33 Glass	3” (76.2mm)	0.5mm ± 0.025mm	Double Sided Polished
Borofloat BF33 Glass	4” (100mm)	0.5mm ± 0.025mm	Double Sided Polished

Silicon Carbide Wafers

The use of Silicon Carbide (SiC) in the semiconductor industry has expanded due to its advantageous physical properties, including its hardness, high thermal conductivity and low coefficient of thermal expansion.

At PI-KEM we offer a range of Silicon Carbide (SiC) wafers in a number of polytypes including both 4H and 6H SiC in a range of wafer diameters. Please contact us for further information.

Semiconductor Wafers

III-V Wafers

Name	Formula
Gallium Arsenide	GaAs
Gallium Phosphide	Gap
Indium Phosphide	InP
Indium Antominide	InSb
Indium Arsenide	InAs

II-VI Wafers

Name	Formula
Zinc Telluride	ZnTe
Zinc Selenide	ZnSe
Cadmium Sulphide	CdS
Cadmium Telluride	CdTe
Cadmium Telluride doped with Zinc	Cd-Zn-Te

SILICON WAFERS

We offer a wide range of silicon wafers, produced to exact customer requirements or as standard wafer specifications available from stock. Below are our most requested lines, however we welcome any enquiry for other specifications.

Grades

Prime	Test	Reclaim	Mechanical

Diameter & Thickness

Size	Standard Thickness (µm)	Tolerance (+/- µm)
1" (25.4mm)	250	15
2" (50.8mm)	275	25
3" (76.2mm)	380	25
4" (100mm)	525	20
5" (125mm)	625	20
6" (150mm)	675	20
8" (200mm)	725	25
Specialist thin wafers available: 1" down to 10 µm thick / 4" down to 90 µm thick / 6" down to 150µm thick		
Custom thicknesses available on request		

Type & Dopant

Type	Dopant
Intrinsic	-
n-type	P- Phosphorous, Sb - Antimony, As - Arsenic
p-type	B - Boron
Heavy P or B doping is also available	

Resistivity

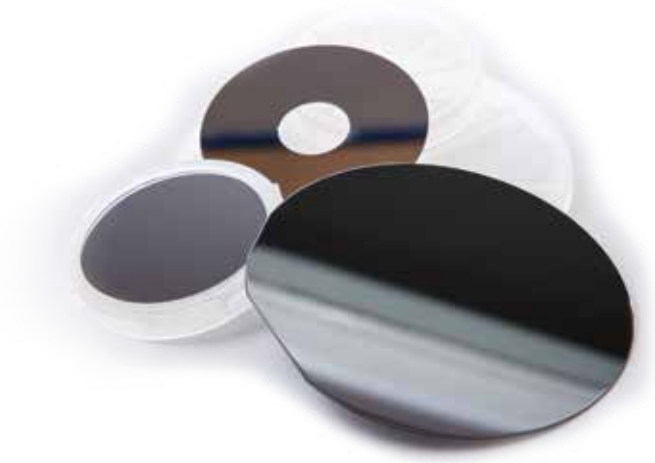
Crystal Growth Method	From	To
Czochralski (CZ)	1 milliohm-cm	150 ohm-cm
Float Zone (FZ)	-	Up to 10,000 ohm-cm

Orientation

Orientation	Tolerance
<100>	Standard +/- 0.5º & Custom up to +/- 0.05º
<110>	
<111>	
Custom Orientations & Off Orientations (up to 40º) available on request	

Surface

As cut	Lapped	Etched	Single Side Polished	Double Side Polished
On polished surface: Roughness <2Å / Total Thickness Variation (TTV) <1µm				
Laser marking available on request				



Silicon as a Substrate

Type	Specifications
Windows	As per customer drawings
Components	As per customer drawings
Blocks	To customer specification including surface roughness & flatness
We can also supply Germanium single crystal components	

Platinised Wafers

	Specifications
Diameter	4" Standard or other sizes available upon request
Layers	Thermal SiO_2, TiO_2 or Ti Adhesion, Platinum E-Beam

Silicon on Insulator (SOI) Wafers

	Specifications
Size	As per customer specification
Layers	Handle, Device, Buried Oxide (BOX) - All layers as per customer specification

SERVICES

Coatings

Type	Method	Thickness (nm)	Diameter
SiO_2 Silicon Dioxide	Wet Oxidation	200-3000	From 1" to 6"
	High Purity Dry Oxidation	20-300	From 1" to 6"
Single face oxidation also available			
Si_3N_4 Silicon Nitride	LPCVD or PECVD	20-500	From 2" to 6"
Metal Coatings including: Cr, Ti, Au, Al, Pt, Mo, W, Ni, Cu, Ir, Ta	PVD Sputtering or Evaporation	20-1000	From 1" to 6" *(depending on metals)*
Other metal coatings & multi-layer deposition available on request			

Dicing Services

Form	Specifications
Tiles	E.g. 10mm x 10mm, 20mm x 20mm (minimum size 1.5mm x 1.5mm)

SUBSTRATE + WAFER STORAGE

We supply a large selection of substrate and wafer storage.

Below are our most requested lines, however we welcome any enquiry for other specifications.

	Product	Description	Sizes
	Individual Wafer Carriers	Each carrier consists of base, lid and retainer spring. Base has concave profile so that only the extreme edge of the wafer is in contact with the carrier.	1", 2", 3", 4" and 6"
	Multi Wafer Storage Boxes	Each box can hold up to 25 wafers. Lid and box have moulded supports so minimal contact is made with the wafer whilst keeping each wafer secure.	2", 3" and 4"
	Gel-Sticky Boxes	Designed to protect delicate components by a sticky carrier gel layer. Components or devices are held securely on surface once in contact with the gel layer. The components can be taken off by tweezers or by hand.	2", 3" and 4"
	Membrane Boxes	High-elastic film designed for packing fragile components with irregular shape or rods. The component is pressed tightly by two layers of high-elastic film and suspended in the middle of the carrier, preventing fragile components from damage. Can be used for various optoelectronic components.	1", 2", 3", 4" and 5"
	Plastic Foam Module Boxes	This packing is designed to protect delicate parts. Used in many fields like optical materials, optoelectronic components, semiconductor, and optical communication. Consists of three cushions, the middle cushion can be customised to a specific shape.	3" and 4" single or multiple wafers
	Die / IC Trays	This system provides a safe and convenient packing and delivery solution for bare die, CSP, optoelectronics and other microelectronic devices. Trays, lids and clamps for single and multiple layers available.	9 - 1600 pockets
	Smart Carrying Box for Rods	Innovative packing box designed for protecting and carrying laser rods or devices of rod shape. Two silicone support seats in the base of the box hold the rods.	Diameter from 3-8mm and up to 160mm (L)

HIGH PURITY EVAPORATIVE COATING PELLETS

We offer a wide range of evaporation materials in pellet, granule and wire form. Below are our most requested lines, however we welcome any enquiry for other specifications such as Alloys, Oxides, Fluorides, Sulphides, Silicides, Carbides, Nitrides.

Precious Metals

Metal	Formula	Typical Available Purities
Gold	Au	99.99+%
Silver	Ag	99.9+%, 99.99+%
Platinum	Pt	99.99+%
Palladium	Pd	99.99+%
Related Precious Metal Alloys are also available upon request		

Base Metals

Metal	Formula	Typical Available Purities
Aluminium	Al	99.99%, 99.999%
Chromium	Cr	99.95%, 99.998%
Cobalt	Co	99.95%
Copper	Cu	99.99%, 99.995%, 99.999%
Hafnium	Hf	99.9% ex Zr
Indium	In	99.99%
Iron	Fe	99.5%, 99.95+%
Lead	Pb	99.99%, 99.999%
Magnesium	Mg	99.95%
Molybdenum	Mo	99.95%
Nickel	Ni	99.98%, 99.995%
Nichrome	Ni:Cr 80:20	99.95%
Niobium	Nb	99.9+% ex Ta
Permalloy	Ni:Fe 80:20	99.99%
Tantalum	Ta	99.95%
Tin	Sn	99.9%, 99.99%, 99.999%
Titanium	Ti	99.97%, 99.99+%
Tungsten	W	99.95%
Vanadium	V	99.7%
Zinc	Zn	99.99%
Zirconium	Zr	99.9% ex Hf, 99.95+%

TARGETS FOR SPUTTERING + LASER ABLATION

We provide an extensive choice of targets, which are available as standard or custom manufacture, in an array of purities, materials and sizes.

Targets are available as monobloc, multi-tile, circular and rotary, however we welcome any enquiry for other specifications.

Metals

Precious Metals and Alloys including:			
Gold (Au)	Palladium (Pd)	Platinum (Pt)	Silver (Ag)
Also related precious metal alloys			

Base Metals including:				
Aluminium (Al)	Chromium (Cr)	Cobalt (Co)	Copper (Cu)	Germanium (Ge)
Indium (In)	Iron (Fe)	Lead (Pb)	Magnesium (Mg)	Manganese (Mn)
Molybdenum (Mo)	Nickel (Ni)	Niobium (Nb)	Selenium (Se)	Silicon (Si)
Tantalum (Ta)	Tellurium (Te)	Tin (Sn)	Titanium (Ti)	Tungsten (W)
Vanadium (V)	Yttrium (Y)	Zinc (Zn)	Zirconium (Zr)	

Metal Alloys & Intermetallics including:	
Aluminium:Copper (Al:Cu)	Aluminium:Silicon (Al:Si)
Chromium:Silicon Dioxide (Cr:SiO_2)	Cobalt:Iron (Co:Fe)
Cobalt:Nickel (Co:Ni)	Germanium:Antimony:Tellurium (Ge:Sb:Te)
Indium:Tin (In:Sn)	Manganese:Iron (Mn:Fe)
Nickel:Chromium (Ni:Cr)	Nickel:Iron (Ni:Fe)
Nickel:Titanium (Ni:Ti)	Terbium:Iron (Tb:Fe)
Tungsten:Titanium (W:Ti)	Zirconium:Aluminium (Zr:Al)
Permalloy	Inconel

Non-Metals

Other Materials including:			
Boron	Metallic Borides	Graphite	Metallic Carbides
Fluorides	Nitrides	Silicides	Sulphides

Oxides

Compositions including:		
Aluminium Oxide (Al_2O_3)	Barium Copper Oxides (BaCu)	Barium Strontium Titanate ($BaSrTiO_3$)
Barium Titanate ($BaTiO_3$)	Barium Zirconate ($BaZrO_3$)	Bismuth Oxide (Bi_2O_3)
Bismuth Titanate ($Bi_{12}TiO_{20}$)	Cerium Oxide (CeO_2)	Chromium Oxide (Cr_2O_3)
Gallium Oxide (Ga_2O_3)	Germanium Dioxide (GeO_2)	Indium Oxide (In_2O_3)
Indium Tin Oxide (ITO / InSn)	Iron Oxide (Fe_2O_3) (Fe_3O_4)	Lanthanum Oxide (La_2O_3)
Lanthanum Cobaltite ($LaCoO_3$)	Lithium Niobate ($LiNbO_3$)	Magnesium Oxide (MgO)
Molybdenum Oxide (MoO_3)	Niobium Oxide (Nb_2O_5)	Lead Titanate ($PbTiO_3$)
Lead Zirconate Titanate ($PbZrTiO_3$)	Rare Earth Oxides	Silicon Dioxide (SiO_2)
Strontium Aluminium Niobates (SrAlNb Oxides)	Strontium Titanate ($SrTiO_3$)	Strontium Zirconate ($SrZrO_3$)
Tantalum Oxide (Ta_2O_5)	Titanium Dioxide (TiO_2)	Tungsten Oxide (WO_3)
Yttrium Barium Copper Oxide (YBaCuO)		Yttrium Oxide (Y_2O_3)
Yttria Stabilised Zirconia (YSZ)	Zinc Oxide (ZnO)	Zirconium Dioxide (ZrO_2)

SERVICES

We offer custom services in relation to sputtering targets:

Bonding

We offer a target bonding service using Indium, Elastomer and Epoxy bonding agents. Our targets can be bonded to standard backing plates or backing plates produced to custom technical drawings provided by the customer.

Precious Metal Reclaim

Benefits

We provide a complete Precious Metal Reclaim Service offering both economic and environmental benefits such as;

- Fast and efficient refining process for high metal return
- Prompt settlement time for improved cash flow
- Reclaim credit which can be used towards your next purchase

Materials Reclaimed

- Gold (Au)
- Silver (Ag)
- Palladium (Pd)
- Platinum (Pt)
- Rhodium (Rh)
- Ruthenium (Ru)
- and more

Source

We recover from a variety of forms, spent or partially used:

- Sputtering Targets, bonded or unbonded
- Chamber scrapings
- Foil linings
- Rare earth oxide powders
- Scrap from large area coatings
- Semiconductor and solar cell wafers
- Coated films
- and other processes

NANO POWDERS

We offer a wide range of nano powders.
Below are our most requested lines, however we welcome any enquiry for other specifications.

ELEMENTS

Aluminium (Al)	Bismuth (Bi)	Carbon (C)	Cobalt (Co)	Chromium (Cr)
Copper (Cu)	Germanium (Ge)	Gold (Au)	Indium (In)	Iridium (Ir)
Iron (Fe)	Molybdenum (Mo)	Niobium (Nb)	Palladium (Pd)	Platinum (Pt)
Rhodium (Rh)	Ruthenium (Ru)	Silicon (Si)	Silver (Ag)	Tantalum (Ta)
Tin (Sn)	Titanium (Ti)	Tungsten (W)	Zinc (Zn)	

OXIDES

Aluminium Oxide (Al_2O_3)	Boron Oxide (B_2O_3)	Bismuth Oxide (Bi_2O_3)
Cobalt Oxide (Co_3O_4)	Chromium Oxide (Cr_2O_3)	Copper Oxide (CuO)
Indium Oxide (In_2O_3)	Iron Oxide (Fe_2O_3) (Fe_3O_4)	Magnesium Oxide (MgO)
Molybdenum Oxide (MoO_3)	Silicon Dioxide (SiO_2)	Titanium Dioxide (TiO_2)
Vanadium Oxide (VO_2)	Tungsten Oxide (WO_3)	Zinc Oxide (ZnO)
Zirconium Dioxide (ZrO_2)		

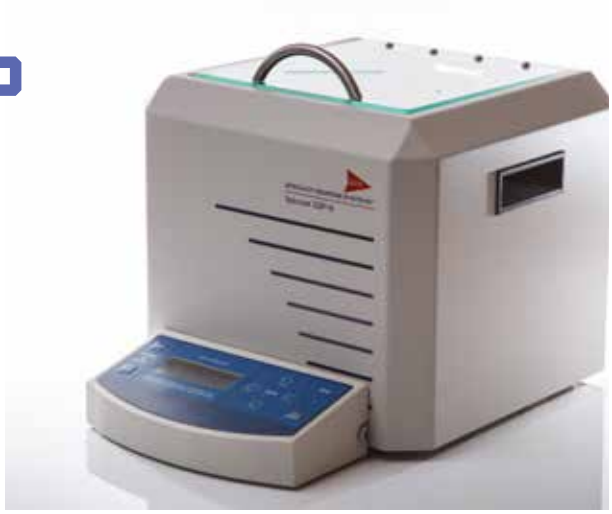
RARE EARTH OXIDES

Cerium Oxide (CeO_2)	Dysprosium Oxide (Dy_2O_3)	Erbium Oxide (Er_2O_3)
Gadolinium Oxide (Gd_2O_3)	Lanthanum Oxide (La_2O_3)	Neodymium Oxide (Nd_2O_3)
Praseodymium Oxide (Pr_6O_{11})	Samarium Oxide (Sm_2O_3)	Terbium Oxide (Tb_4O_7)
Yttrium Oxide (Y_2O_3)	Ytterbium Oxide (Yb_2O_3)	

COMPOUNDS

Aluminium Nitride (AlN)	Aluminium Zinc Oxide (AZO)	Boron Carbide (B_4C)
Boron Nitride (BN)	Barium Sulphate ($BaSO_4$)	Barium Titanate ($BaTiO_3$)
Cobalt Iron Oxide ($CoFe_2O_4$)	Cobalt Zinc Iron Oxide ($Co_{0.5}Zn_{0.5}Fe_2O_4$)	Indium Tin Oxide (ITO In_2O_3:SnO_2)
Lanthanum Strontium Manganite (LSM)	Nickel Iron Oxide ($NiFe_2O_4$)	Nickel Zinc Iron Oxide($Ni_{0.5}Zn_{0.5}Fe_2O_4$)
Silicon Carbide (Sic)	Silicon Nitride (Si_3N_4)	Strontium Aluminate ($SrAl_{12}O_{19}$)
Strontium Titanate ($StTiO_3$)	Titanium Carbide (TiC)	Titanium Nitride (TiN)
Tungsten Carbide (WC)	Tungsten Carbide Cobalt (WC-Co)	Yttrium Aluminium Oxide ($Y_3Al_5O_{12}$)
Zinc Carbide (ZnC)	Zinc Iron Oxide ($ZnFe_2O_4$)	

SPIN + DIP COATERS



We supply a range of spin and dip coaters for electronic and photonic research.

PI-KEM Ltd are the exclusive European distributors for Specialty Coating Systems, Inc USA

We also distribute on behalf Navson Technologies and Chemat Technology, Inc USA.

Below are our most requested lines, however we welcome any enquiry for other specifications and your custom chuck needs.

Spin Coaters - SCS Series

Spin Coater Options	Specifications
Bowl Size	7”, 8”, 12” & 15” Bowl Diameters
Control	Manual & Programmable options
Dispensers	Manual, Semi-Automatic & Automatic options
Chucks	Standard Sizes & Custom Designs
Additions	• Vacuum Pumps - Oiled or Oil-Free • Air Compressors • Hot Plates (50-350°C) Up to 150mm Diameter

Spin Coaters - Navson

Spin Coater Options	Specifications
Bowl Size	6” & 9” Bowl Diameters
Control	Programmable options via touch screen control panel
Dispensers	Manual & Automatic options
Chucks	Standard Sizes & Custom Designs
Additions	• UV Cover • Infrared Heated Cover

Dip Coaters - SCS

Dip Coater Options	Specifications
Substrate Size	Up to 60cm x 45cm
Control	Manual & Programmable options

Below are our most requested lines, however we welcome any enquiry for other requirements:

Advanced Materials

Sputtering Targets, Ceramics, Single Crystal & Substrates, Wafers (including Silicon & Glass), Quartz & Sapphire Components, Rare Earth Oxide Powders, Li-ion Battery Powders and Electrodes, Na-ion Materials, Supercapacitor Chemicals, Precious Metals, Graphene, High Tempertaure Adhesives, Optical Coatings, High Purity Evaporative Coating Pellets, Photovoltaic Chemicals, Nano Powders

Equipment

Chemical Processing and Handling: (Grinding & Polishing Machines, Diamond Blade & Wire Saws)

Thin Film Coating: (Spin Coaters, Dip Coaters, Tape Casting, Sputtering Machines, Spray Coaters)

Li-ion Battery Research Equipment: (Vacuum Mixers, Electrode Coating Machines, Cell Production, Testing & Analysing Machines)

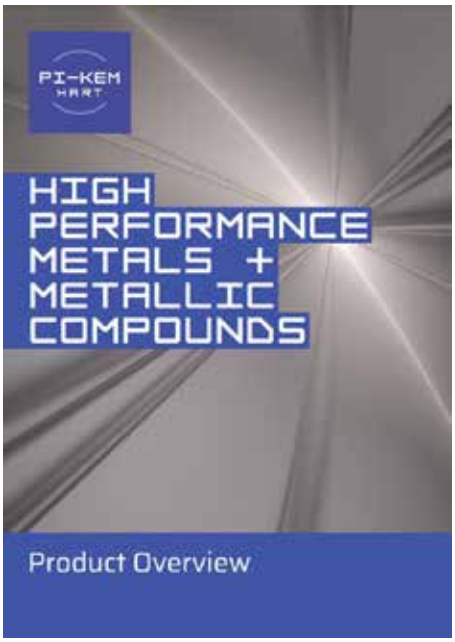
Furnaces: (Tube, Muffle, RTP & CVD Furnaces, Single or Multi Zone)

Ionic Contamination Test Equipment: (Ionographs)

Storage: (Substrate & Wafer Storage, Glove Boxes, Membrane Boxes, Vacuum Desiccators)

Services: (Precious Metals Reclaim Services & Target Bonding)

Please request one of our additional product catalogues or visit www.pi-kem.co.uk to download your copy:



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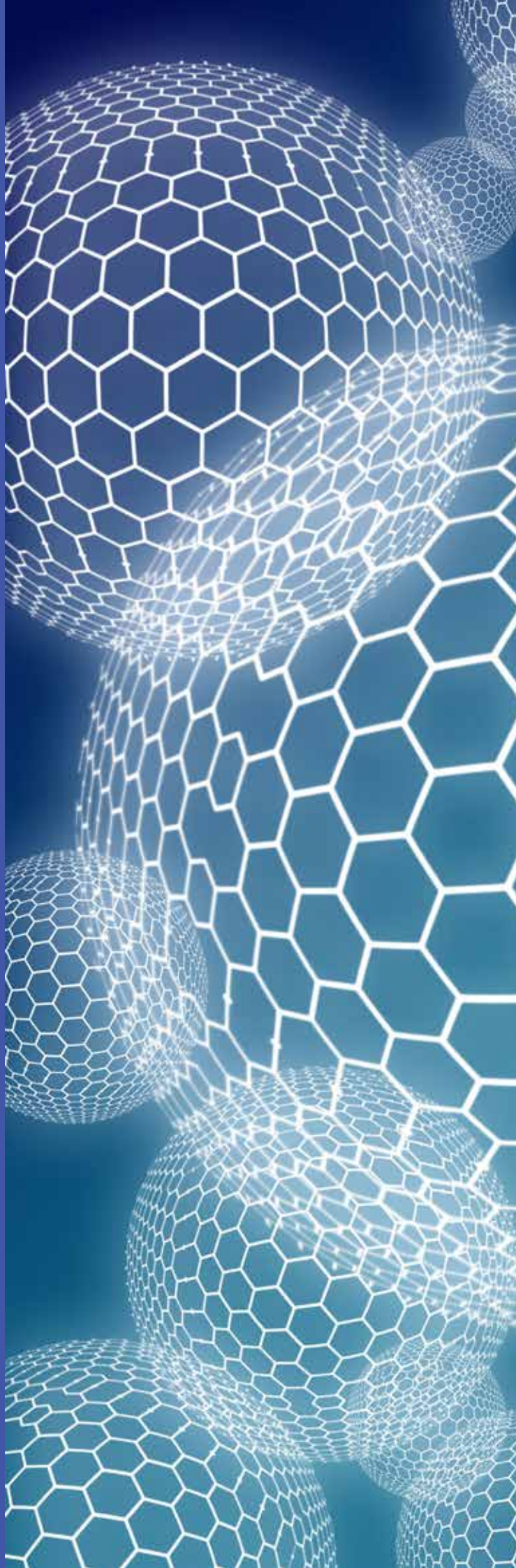

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