



Business Case Study

Ceramic Forming Experts

Case study: Ceramic Forming Experts (1 / 2)

Client	Leading semiconductor processing equipment manufacturer
Industry	Ceramics
Products	High temperature oxides (aluminium oxide, yttrium oxide, zirconium dioxide, etc)

Context

- Client is keen to identify most promising ceramic forming expert companies / entities with unique synthesis capabilities for high temperature oxides (Ceramics)

Key Business Questions

- Universe of companies having ceramic synthesis / forming capabilities
- Universe of research institutes and universities with advanced ceramic synthesis / forming capabilities
- Which entities has multiple synthesis / forming capabilities?
- Which entities (companies and academia) has short loop testing capabilities?

Engagement Scope

1	Universe building of companies	2	Universe building of research institutes / universities	3	Profiling of the companies & other shortlisted entities	4	Key findings and conclusions
	<ul style="list-style-type: none">▪ Building a universe of companies offering ceramic forming expertise▪ Analysis of companies w.r.t. materials it can process, type of synthesis / forming techniques and short-loop testing capabilities▪ Shortlisting of companies based on KPIs such as multiple forming capabilities, number of materials it can offer, short-loop testing capabilities, etc.		<ul style="list-style-type: none">▪ Building a universe of companies offering ceramic forming expertise▪ Analysis of companies w.r.t. materials it can process, type of synthesis / forming techniques and short-loop testing capabilities▪ Shortlisting of entities based on KPIs such as years of experience, materials it can offer, publication / patent count, etc.		<ul style="list-style-type: none">▪ Profiling of companies including<ul style="list-style-type: none">▪ Brief overview▪ Geographic coverage▪ Synthesis / forming capabilities▪ Short-loop & other testing capabilities▪ Applications it serves to▪ Key stakeholder and relevant publication for entities		<ul style="list-style-type: none">▪ Most promising companies with synthesis / forming capabilities▪ Most promising research institutes / universities with synthesis / forming capabilities

Case study: Ceramic Forming Experts (2 / 2)

Research Methodology

Secondary Research

- Paid commercial, IP, technical databases and scientific literature
- Company, analyst, trade journal, association, etc. publications
- Conferences and magazines, etc,
- Patent databases such as Orbit

Benefits to Client

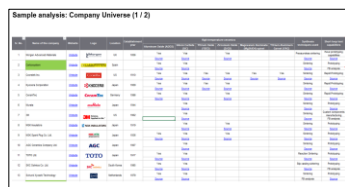
- Universe of companies with ceramic forming / synthesis capabilities
- Shortlisted and most promising company profiles
- Universe of research institutes / universities with ceramic forming / synthesis capabilities
- Shortlisted and most promising institutes / universities profiles

Sample Analysis

1

Universe building of companies

Sample analysis: Company Universe (1 / 2)



Sample analysis: Company Universe (2 / 2)



2

Universe building of research institutes / universities

Sample analysis: Research Institute & universities Universe (1 / 2)



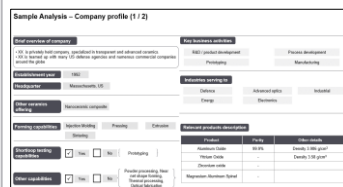
Sample analysis: Research Institute & universities Universe (2 / 2)



3

Profiling of the companies & other shortlisted entities

Sample Analysis - Company profile (1 / 2)

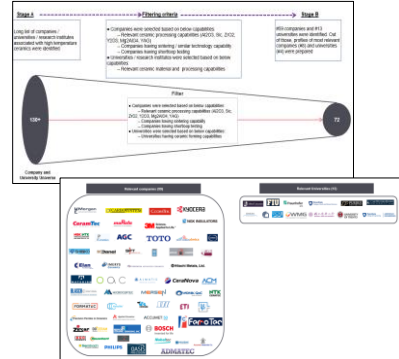


Sample Analysis - Company profile (2 / 2)








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Key findings and conclusions



Sample analysis: Company Universe (1 / 2)

Sr. No.	Name of the company	Website	Logo	Location	Establishment year	High temperature ceramics						Synthesis techniques used	Short-loop test capabilities
						Aluminum Oxide (Al2O3)	Silicon Carbide (SiC)	Yttrium Oxide (Y2O3)	Zirconium Oxide (ZrO2)	Magnesium Aluminate (Mg2AlO4) spinel	Yttrium Aluminum Garnet (YAG)		
1	Morgan Advanced Materials	Website		UK	1856	Yes	Yes		Yes			Pressureless sintering	Have prototyping capabilities
						Source	Source		Source			Source	Source
2	Carbosystem	Website		Spain		Yes	Yes					Sintering	Prototyping
						Source	Source					Source	FB analysis
3	Coorstek Inc.	Website		US	1910	Yes	Yes	Yes	Yes	Yes	Yes	Sintering	Rapid Prototyping
						Source	Source	Source	Source	Source	Source	Source	Source
4	Kyocera Corporation	Website		Japan	1959	Yes	Yes	Yes	Yes			Sintering	Rapid Prototyping
						Source	Source	Source	Source			Source	Source
5	CeramTec	Website		Germany	1996	Yes	Yes		Yes			Sintering	Rapid Prototyping
						Source	Source		Source			Source	Source
6	Murata	Website		Japan	1944		Yes					Sintering	Prototyping
							Source					Source	Source
7	3M	Website		US	1902		Yes					Sintering	Custom components manufacturing
							Source					Source	FB analysis
8	NGK Insulators	Website		Japan	1919		Yes		Yes			Sintering	Prototyping
							Source		Source			Source	Source
9	NGK Spark Plug Co. Ltd.	Website		Japan	1936	Yes	Yes	Yes				Sintering	Prototyping
						Source	Source	Source				Source	Source
10	AGC Ceramics Company Ltd.	Website		Japan	1907		Yes					Sintering	Prototyping
							Source					Source	Source
11	TOTO Ltd.	Website		Japan	1917	Yes	Yes					Reaction Sintering	Prototyping
						Source	Source					Source	Source
12	SKC Solmics Co. Ltd.	Website		South Korea	1995	Yes	Yes					Slip casting sintering	Prototyping
						Source	Source					Source	FB analysis
13	Schunk Xycarb Technology	Website		Netherlands	1979	Yes	Yes					Sintering	Prototyping
						Source	Source					FB analysis	Source

Sample analysis: Company Universe (2 / 2)

Sr. No.	Name of the company	Website	Logo	Location	Establishment year	High temperature ceramics						Synthesis techniques used	Short-loop test capabilities
						Aluminum Oxide (Al ₂ O ₃)	Silicon Carbide (SiC)	Yttrium Oxide (Y ₂ O ₃)	Zirconium Oxide (ZrO ₂)	Magnesium Aluminate (Mg ₂ AlO ₄) spinel	Yttrium Aluminum Garnet (YAG)		
14	Micro Ceramics Ltd.	Website		Israel	1988	Yes	Yes	Yes	Yes			Pressing & Sintering	Prototyping
						Source	Source	Source	Source			Source	Source
15	Shinko Electric Industries Co. Ltd.	Website		Japan	1946	Yes						Firing and forming of ceramics	New product development
						Source						Source	Source
16	McDanel Advanced Ceramic Technologies LLC	Website		US		Yes			Yes			Sintering	Prototyping
						Source			Source			Source	Source
17	Saint Gobain	Website		France	1665		Yes		Yes			Pressureless sintering	Rapid Prototyping
							Source		Source			Source	Source
18	Small Precision Tools	Website		US	1980	Yes			Yes			Sintering	Prototyping
						Source			Source			Source	Source
19	Insaco Inc.	Website		US	1947	Yes	Yes		Yes			Sintering	Low volume prototype machining
						Source	Source		Source			Source	Source
20	Applied Ceramics Inc.	Website		US	1967	Yes			Yes			Sintering	Custom solution capabilities
						Source			Source			Source	Source
21	Alumina Ceramic Components Inc.	Website		US	1994	Yes						Firing / Sintering	Prototype-development
						Source						Source	Source
22	Elan Technology	Website		US	1948	Yes			Yes			Sintering	Prototype designing
						Source			Source			Source	Source
23	Imerys Ceramics	Website		France	1782	Yes	Yes		Yes			Firing of ceramics	Rapid Prototyping
						Source	Source		Source			Source	Source
24	Nishimura Advanced Ceramics	Website		Japan	1918	Yes		Yes	Yes			Sintering	Fast prototyping
						Source		Source	Source			Source	Source
25	Hitachi Metals Ltd.	Website		Japan	1956		Yes					Sintering	Rapid Prototyping
							Source					Source	Source
26	Materion Corporation	Website		US	1931	Yes						Sintering	Rapid prototyping
						Source						Source	Source

Sample analysis: Research institute & universities Universe (1 / 2)

Sr. No.	Name of the University	Website	Location	Key stakeholder	Designation	Published relevant paper	Materials worked on	Partnerships	Capabilities of university
1	Alfred University	Website	US	Yiquan Wu David Gottfried	Professor (Ceramic Engineering) Deputy Director Business Development	Spark Plasma Sintering of Oxides and Carbide Dispersed Zirconia Inert Matrix Fuels	Bio ceramics; Carbon-based composites; Electronic ceramics; Glass; Metal-ceramic composites; Optical materials; Polymers;		Alfred university has CACT (Center for Advanced Ceramics Technology) department involved with many formulation activities such as: 1. Development of ceramic and glass materials 2. different products in energy, environment, healthcare, Defense and
2	Florida International University	Website	US	Zhe Cheng	Assistant Professor	Synthesis of high temperature ceramic powders (Patent)	Carbides of aluminum, Yttrium and others		Spark Plasma Sintering Laboratory
3	Institute of Science and Technology for Ceramics	Website	Italy	Anna Tampieri	Director	Ultra High Temperature Ceramics: Microstructure Control and Properties Improvement Related to Materials Design and Processing Procedures	Carbides, Borides and Nitrides	1. China Shanghai Institute of Ceramics, Ultrarefractory ceramics 2. Portugal CICECO- University of	Research institute has capabilities in synthesis, forming and sintering
4	Fraunhofer University	Website	Germany	Dr.-Ing. Sabine Regand Dipl.-Krist. Jörg Adler	Head of Department Oxide Ceramics Head of Department Nonoxide Ceramics	Phase Evolution and Shrinkage Behavior of ZnO Ceramics during Liquid Phase Sintering In-situ sintering studies on nano-alumina	Oxide (Al ₂ O ₃ , ZrO ₂ , MgO, Al ₂ O ₃ , Y ₂ O ₃ , SiO ₂ , Garnet, etc.), Non-Oxide ceramics (Carbide ceramics, Nitride Ceramics, Magnetic ceramics)		For Oxide Ceramics: Services Offered 1. Material synthesis and development 2. Material specific shaping For Oxide Ceramics: Expertise 1. Materials development 2. Powder technology and semifinished products
5	Penn University	Website	US	Clive Randall	Director, Materials Research Institute Professor of Materials Science and Engineering	Cold Sintering Process: A Novel Technique for Low-Temperature Ceramic Processing of Ferroelectrics	Na ₂ Mo ₂ O ₇ , Zirconium Oxide (yttria stabilized), V ₂ O ₅ , SiC, Aluminum Oxide, Silicon Nitride		Penn university is having capabilities in Synthesis, Fabrication and Characterization of ceramic materials. New methods of processing advanced ceramic materials are being discovered by Penn University namely templated grain growth, microwave sintering, nanometer to micrometer synthesis and processing in water and micro and nanoscale high pressure techniques. University has MCL X-Ray diffraction equipment for characterization of materials, they are also equipped with Scanning Electron Microscopy focused electron beam for scanning. Material characterization equipment: 1. Electron microscopy (SEM & TEM) 2. Atomic Force microscopy (AFM) 3. X-ray diffraction (XRD) 4. Fourier Transform Infrared Spectroscopy (FTIR) 5. Raman spectroscopy
6	Purdue University	Website	US	Rodney Trice	Professor of Materials Engineering	Near-Net Shaping Of Silicon Nitride Via Aqueous Room-Temperature Injection Molding And Pressureless Sintering	Silicon Nitride		

Sample analysis: Research institute & universities Universe (2 / 2)

Sr. No.	Name of the University	Website	Location	Key stakeholder	Designation	Published relevant paper	Materials worked on	Partnerships	Capabilities of university
7	International Institute for Nanocomposite Manufacturing, Warwick Manufacturing Group, University of Warwick	Website	UK	Dr Claire Dancer	Associate Professor	Flash sintering of ceramic materials	Zirconia	Engineering and Physical Sciences Research Council (EPSRC), European Regional Development Fund (ERDF) and Innovate UK	Facilities: 1. Characterisation laboratories 2. Wet chemistry laboratory 3. Processing hall
8	Onera (French Aerospace lab)	Website	France	Justin Jean Francois		Sintering and properties of Ultra High Temperature Ceramics for aerospace applications	SiC		
9	PennState College of Engineering	Website	US	Namiko Yamamoto	Assistant Professor	Demonstrating low-temperature sintering of boron carbide powders	Boron carbide	Office of Naval Research	1. Real-time observation of particle assembly in oscillating magnetic fields 2. Triaxial Helmholtz Coil System 3. Chemical vapor deposition
10	University of Trento	Website	Italy	Vincenzo M. Sola	Professor	Spark plasma sintering of alumina/yttria-doped silicon carbide	SiC	MIUR - Ministero Istruzione Università e Ricerca	1. Material characterization University of Trento also has the capabilities of flash sintering (which
11	National Tsing Hua University Department of Materials Science and Engineering	Website	Taiwan	Jau-Ho Jean	Distinguished Professor	Constrained sintering of Bi2O3-doped ZnO	Bi2O3	Ministry of Science and Technology, Taiwan	1. High temperature furnace 2. Laser measurement system 3. Ball mill and 3D powder mixer 4. Particle size and surface potential meter 5. Powder particle size, density and surface area measurement instrument
12	University of California	Website	US	Joanna Groza	Professor	A Comparison Between FAST and SPS Apparatuses Based on the Sintering of Oxide Ceramics	Aluminum Oxide, Yttria stabilized zirconia	Alliances 1. ONR (Office of Naval Research) 2. AFRL (Air Force Research Laboratory) 3. AFOSR (US Air Force Office of Scientific Research)	Capabilities: Embrace all aspects of materials technology, including design, synthesis, processing, characterization and modeling of composites, their constituents and protective coatings
13	Case Western Reserve University (Ohio)	Website	US	Frank Ernst	Department Chair	Research topics: Cold pressing and sintering	Different type of ceramics		Consolidation processing by cold-pressing and sintering , electric-field-assisted compaction, or hot-pressing, injection molding Conventional ceramic processing capabilities: Numerous ball mills, freeze mill, uniaxial press, manual and automatic machining saws, polishing wheels, slip casting molds, drying ovens and several furnaces

Sample Analysis – Company profile (1 / 2)

Brief overview of company

- XX is privately held company, specialized in transparent and advanced ceramics.
- XX is teamed up with many US defense agencies and numerous commercial companies around the globe

Establishment year

1992

Headquarter

Massachusetts, US

Other ceramics offering

Nanoceramic composite

Forming capabilities

Injection Molding

Pressing

Extrusion

Sintering

Shortloop testing capabilities



Yes



No

{ Prototyping }

Other capabilities



Yes



No

{ Powder processing, Near net shape forming, Thermal processing, Optical fabrication }

Key business activities

R&D / product development

Process development

Prototyping

Manufacturing

Industries serving to

Defence

Advanced optics

Industrial

Energy

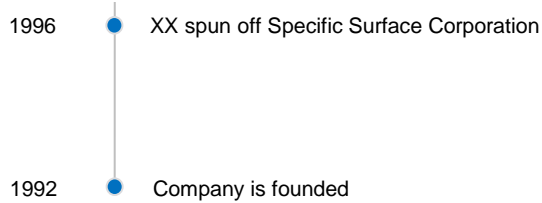
Electronics

Relevant products description

Product	Purity	Other details
Aluminum Oxide	99.9%	Density 3.986 g/cm ³
Yttrium Oxide	-	Density 3.58 g/cm ³
Zirconium oxide	-	
Magnesium Aluminum Spinel	-	

Sample Analysis – Company profile (1 / 2)

History and background (timeline)



Affiliations



Company vision

- XX's mission is to be the world leader in high performance transparent ceramics.

Contact details



Headquarters
Address: XX
Telephone: + XX

Miscellaneous information

- Company provides research, development and manufacturing for a wide range of clients in the defense, industrial and commercial markets.

Thank you

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