

**Svenska
Keraminstitutet**
SWEDISH CERAMIC INSTITUTE

Annual Report 2002

Swedish Ceramic Institute

Svenska Keraminstitutet AB
Box 5403
SE-402 29 GÖTEBORG
SWEDEN

Telephone: +46 31 772 05 00
Telefax: +46 31 18 53 80
E-mail: info@sci.se
Home page: <http://www.sci.se>

Introduction

The year 2002 has been characterised by further confidence from industry in the work done at the SCI resulting in an increased interest in the general research programme and an increased number of commissions. An important event has been the refurbishment of the SCI building. In September the staff moved back from temporary premises to an extended floor, and part of the equipment was transferred to completely refurbished laboratories. In December the building work was completed and the remaining equipment was installed in the new laboratories. SCI now has at its disposal 1400 m² of modern laboratories especially designed for work with ceramics and powder metals. The new premises give much improved working environments, a large hall for equipment requiring large space, and significantly better possibilities of working with demanding projects in terms of, for instance, cleanness and hazardous materials. The area for offices, meeting rooms and a lecture hall and so on totals 500 m².

In connection with the refurbishment of the SCI building a stationary system was installed for the distribution of gases for processing and analysing purposes, such as nitrogen, argon, hydrogen and helium. A new specific surface area analyser (BET) has been acquired.

The discussions on the restructuring of the industrial research institutes in Sweden have continued and the government minority owner of the institutes, IRECO Holding AB, has proposed altogether four groupings of institutes. It is planned that SCI will be part of a major *Institute for Materials and Engineering Industry* together with IFP SICOMP AB, IVF*, IM, KI, MEFOS and Gjuteriföreningen.

A new member of the Industrial Ceramic Research Association, and thus the SCI, is SlipNaxos AB, Sweden. 30% of the members are Small and Medium-sized Enterprises.

2002 was the last year of the so-called Framework Programmes for the industrial research institutes in Sweden. The Swedish government is no longer going to support general research programmes financed jointly by industry and government. From 2003 SCI's members will finance the long-term research on ceramics alone through their membership fees. The government, through their authorities Vinnova and IRECO, supports a so-called competence project on mesoporous structures, in which SCI co-operates with YKI, Institute for Surface Chemistry.

A new large project on tile decoration, financed by the European Union, has commenced, but SCI has been less successful in acquiring project funding from the Swedish government authority Vinnova.

The activities towards Small and Medium-sized Enterprises have been at a much lower level compared with the last few years, and primarily connected to remaining networks with other industrial research institutes. New network participation for SCI is the EU Innovation Relay Centre (IRC) West and South Sweden. Short courses on *Joining of Ceramics*, *New Prototypes of Ceramics* and *Firing of Ceramics* were carried out, and one workshop on *Electrical Properties of Ceramics in Advanced Applications* was arranged in cooperation with SKF AB.

The commissions from industry increased by seven percent compared with the year before.

As 2002 was the final year of the 2000–2002 Framework Programme at the Swedish Ceramic Institute, we publish a special booklet in the 'Ceramic Development' series, in which the results of this long-term research programme are presented together with information on other projects with public funding. This annual report is therefore a short version with no technical reporting on the research projects.

Roger Carlsson
Professor
Managing Director

* IVF = IVF Industrial Research and Development Corporation, IM = Swedish Institute for Metals Research, KI = Swedish Corrosion Institute, MEFOS = Metallurgical Research Institute AB, and Gjuteriföreningen = Swedish Foundry Association.

Board of Directors and Auditor

Board of Directors

The Chairman of the Board is appointed by The Industrial Ceramic Research Association and approved by IRECO Holding AB:

Mr Michael Hatcher, M Sc, KemiTekniskt Centrum, Ljungaverk, Chairman

Members appointed by **IRECO Holding AB**:

Mr Thomas Lewin, Associate Professor, Ericsson AB, Mölndal

Ms Agneta Odén, Associate Professor, Nobel Biocare Procera AB, Stockholm

Professor Eva Olsson, Chalmers University of Technology, Göteborg

Members appointed by the **The Industrial Ceramic Research Association**:

Mr Thomas Johansson, Associate Professor, Ifö Ceramics AB, Bromölla

Mr Claes Kuylenstierna, M Sc, Volvo Materialteknik AB, Göteborg

Mr Hans-Olof Nilsson, Designor AB, Lidköping

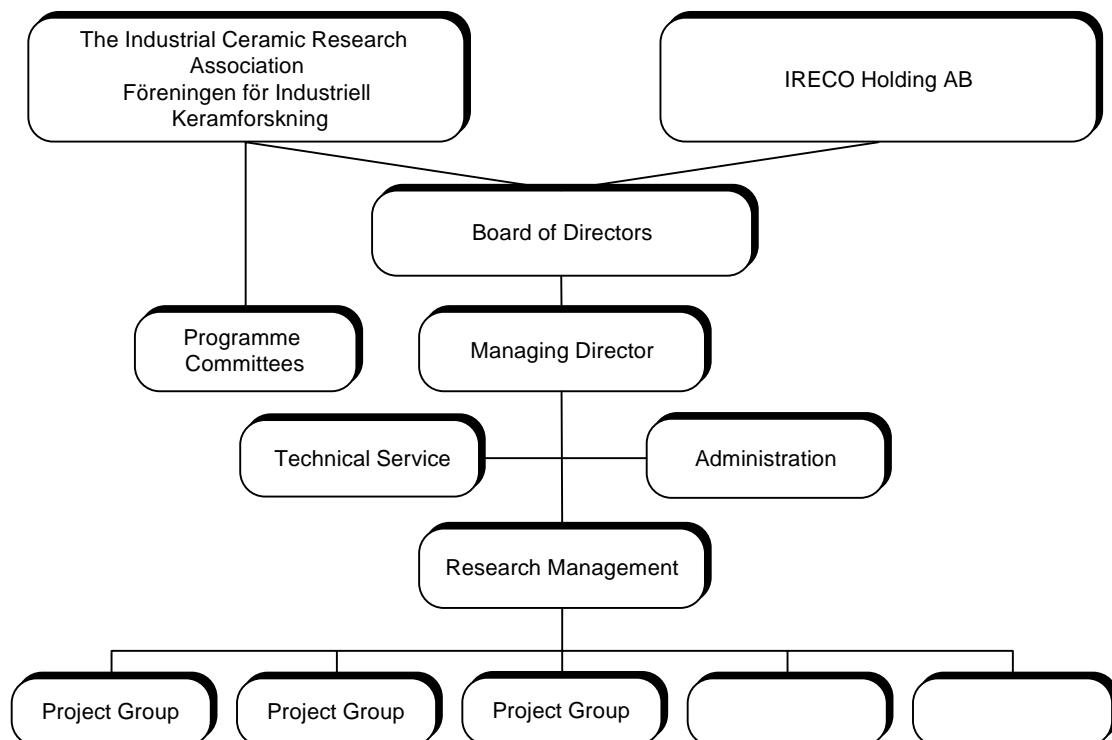
Staff representative appointed by SIF:

Ms Birgitta Eyzop, M Sc, Swedish Ceramic Institute

Auditor

Mr Rein Leesment, Chartered Accountant, KPMG Bohlins AB, Göteborg

Organisation of Svenska Keraminstitutet AB



Economy

Income Statement

	2002		2001	
	kSEK	kEURO*	kSEK	kEURO†
Operating income				
Framework Programme				
The Industrial Ceramic Research Association	1 913	209	2 020	215
NUTEK/VINNOVA and IRECO	1 827	200	2 412	257
Separate projects	6 970	761	6 659	708
Commissions	4 467	488	4 191	446
Total income	15 176	1 657	15 282	1 625
Operating expenses				
Project-bound costs	-2 004	-219	-2 322	-247
Other external costs	-2 461	-269	-2 049	-218
Costs of personnel	-10 281	-1 123	-10 206	-1 085
Depreciation	-1 239	-135	-836	-89
Total expenses	-15 985	-1 746	-15 412	-1 639
Operating profit/loss	-809	-88	-131	-14
Result from financial investments				
Net interest income and expenses	74	8	188	20
Result after financial items	-736	-80	58	6
Appropriations	97	11	-16	-2
Tax on the result for the year	0	0	-13	-1
RESULT FOR THE YEAR	-639	-70	29	3

* Rate of exchange at the accounting year-end 2002-12-31: 1 EURO = SEK 9.157

† Rate of exchange at the accounting year-end 2001-12-31: 1 EURO = SEK 9.404

Balance Sheet

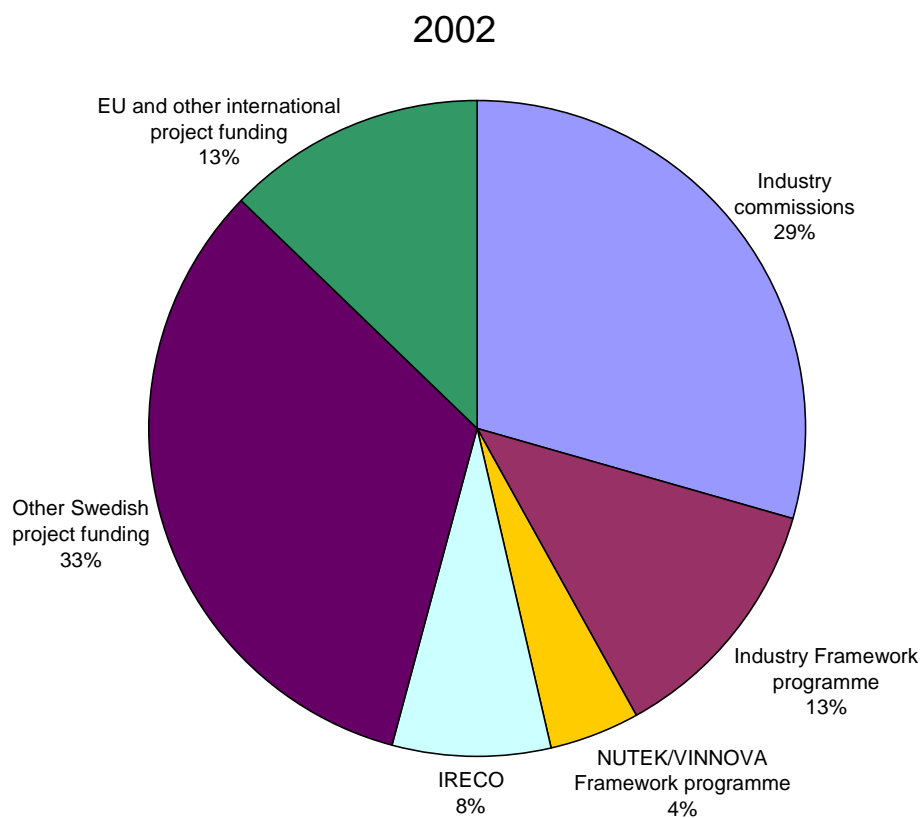
	31 December 2002		31 December 2001	
	kSEK	kEURO	kSEK	kEURO
ASSETS				
Fixed assets				
Tangible assets	3 341	365	1 920	204
Financial assets	0	0	0	0
Total fixed assets	3 341	365	1 920	204
Current assets				
Short-term claims				
Accounts receivable – trade	3 902	426	2 488	265
Other receivables	1 463	160	2 042	217
Prepaid expenses and accrued income	400	44	335	36
Total short-term claims	5 765	630	4 865	517
Liquid funds	2 860	312	6 447	686
Total current assets	8 625	942	11 312	1 203
TOTAL ASSETS	11 966	1 307	13 232	1 407
EQUITY AND LIABILITIES				
Equity				
Restricted equity				
Share capital 1 000 shares at a nominal value of SEK 100	100	11	100	11
Legal reserv	20	2	0	0
Total restricted equity	120	13	100	11
Non-restricted equity				
Balance brought forward	6 051	661	6 042	643
Result for the year	-639	-70	29	3
Total non-restricted equity	5 412	591	6 071	646
Total equity	5 532	604	6 171	656
Untaxed reserves	599	65	696	74
Short-term liabilities				
Accounts payable – trade	1 960	214	1 835	195
Income tax liability	382	42	306	32
Other short-term liabilities	2 506	274	3 341	355
Accrued expenses and prepaid income	987	108	884	94
Total short-term liabilities	5 835	637	6 365	677
TOTAL EQUITY AND LIABILITIES	11 966	1 307	13 232	1 407

Key Ratios

	2002		2001	2000	1999	1998
	MSEK	MEURO	MSEK	MSEK	MSEK	MSEK
Turnover	15.2	1.7	15.3	18.3	16.6	14.0
Operating profit/loss	-0.8	-0.1	-0.1	1.3	1.4	0.6
Result after financial items	-0.7	-0.1	0.1	1.5	1.5	0.7
Total assets	12	1.3	13.2	15.5	9.9	8.4
Solidity	50%	50%	50%	43%	56%	54%
Investments/turnover	18%	18%	8%	4%	7%	4%
Number of employees	24	24	25	25	25	23
Man-years (full-time equivalent)	18.9	18.9	21.1	22.1	22.8	19.3
Turnover/man-year	0.80	0.1	0.73	0.83	0.73	0.72

Financing

	2002		2001	
	MSEK	MEURO	MSEK	MEURO
Industry commissions	4.5	0.5	4.2	0.4
Industry Framework programme	1.9	0.2	2.0	0.2
NUTEK/VINNOVA Framework programme	0.7	0.1	1.0	0.1
IRECO	1.2	0.1	1.4	0.2
Other Swedish project funding	5.0	0.6	5.3	0.6
EU and other international project funding	1.9	0.2	1.4	0.1
Extraordinary income	0	0.0	0	0.0
Total income	15.2	1.7	15.3	1.6



Scope of the Research 2002

Framework Programme 2000–2002 – *Engineering Ceramics*

Projects

Coordinator	*Tekn dr Eva Lidén
Project Committee Chairman	Docent Agneta Odén, Nobel Biocare Procera AB
Project 261	Multifunktionella/Responsiva polymerer för extrema partikelkoncentrationer (<i>Multifunctional Polymers for Powder Suspensions with Extreme Solids Loading</i>)
Project Manager	Civ ing Ola Lyckfeldt
Project 262	”Rapid prototyping” av keramer (<i>Rapid Prototyping of Ceramics</i>)
Project Manager	Civ ing Karin Lindqvist
Project 263	Kompakteringsbeteende och friktion vid pressning av keram- och metallpulver (<i>Compaction Behaviour and Friction During Pressing of Ceramic and Metal Powders</i>)
Project Manager	Civ ing Birgitta Eyzop
Project 264	Kiselnitrid med hög värmeledning (<i>Silicon Nitride with High Thermal Conductivity</i>)
Project Manager	Civ ing Petrus Brännvall/Tekn dr Eva Lidén
Project 265	Kiselnitrid i tribologiska applikationer (<i>Silicon Nitride in Tribological Applications</i>)
Project Manager	Civ ing Birgitta Eyzop

Framework Programme 2000–2002 – *Electroceramics*

Project 266	LTCC-kretsar, RF- och MW-filter i planära mono- och multilagerstrukturer (<i>LTCC Systems, RF and MW Filters (Resonators) in Planar Structures for Wireless Communication</i>)
Project Manager	Civ ing Jesper Brandt
Project Committee Chairman	Tekn dr Torbjörn Olsson, Allgon System AB

Framework Programme 2000–2002 – *Traditional Ceramics*

Project 267	Korrosionsresistenta glasyrer och modifierade gjutmassor (<i>Corrosion Resistant Porcelain Glazes and Modified Slips</i>)
Project Manager	Civ ing Sven Karlsson
Project Committee Chairman	Ing Hans-Olof Nilsson, Designor AB
Project 268	Kiselsyrasoler som multifunktionella tillsatsmedel i eldfasta gjutmassor (<i>Silica Sols as Functional Additives in Refractory Castables</i>)
Project Manager	Civ ing Sven Karlsson
Project Committee Chairman	Civ ing Bozena Tokarz, Eka Chemicals AB

* We have chosen to leave all titles as they are in Swedish in this section of the Annual Report.

Project 269 **Antivätmedel i eldfasta material för smältning av icke-järnmetaller (*Non-Wetting Agents for Refractories*)**
Project Manager Civ ing Monica Cristea
Project Committee Chairman Civ ing Jérôme Soudier, Lafarge Svenska Höganäs AB

SME Projects

Project 298 **IF Skaraborg**
Project Manager Fil dr Kent Rundgren

Project 299 **IF-LUC-Kalmar: Industriforskningsinstitut och Lokala Utvecklingscentra i samverkan - en resurs för näringslivets tillväxt i Kalmar län**
Project Manager Tekn dr Eva Lidén

Project 309 **Aluminatbaserade biokeramer med unik formbarhet (*Aluminate-based Bioceramics with Unique Mouldability*)**
(Vinnova dnr 341-2001-04981)
Project Manager Civ ing Karin Lindqvist

Project 311 **Förbättrad kvalitet och produktionsmiljö vid tillverkning av aluminium- och stålrör från metallband (*Improved Quality and Production Environment in Manufacturing Aluminum and Steel Tubes of Metal Strip*)**
(Vinnova dnr 341-2001-04972)
Project Manager Docent Robert Pompe

Project 312 **Alkali-resistent keramiska material för förbränningsapplikationer (*Alkali Resisting Ceramic Material for Combustion Applications*)** (Vinnova dnr 341-2001-04936)
Project Manager Civ ing Ola Lyckfeldt

Project 313 **SMF-verksamhet vid Svenska Keraminstitutet 2002 (*SME Activities at SCI - 2002*)** (Vinnova dnr 341-2001-05063)
Project Manager Tekn dr Eva Lidén

Project 314 **Marknadsanpassad produktframtagning för småföretag (*Market-driven Product Development for SME*)**
Project Manager Tekn dr Eva Lidén

Project 315 **Kostnadseffektiv och kvalitetssäkrad ljusbågssprutning för krävande applikationer (*Cost-effective and Quality-assured Arc Spraying for Demanding Applications*)**
Project Manager Docent Robert Pompe

Project 316 **Tillverkning av keramiska gjutformar med ny SFF-teknik (*Manufacturing of Ceramic Moulds with New SFF Technique*)**(Vinnova dnr 341-2001-05045)
Project Manager Civ ing Karin Lindqvist

International Co-operative Projects

Project 125	Multifunctional Ceramic Laminates for Engineering Applications (NEDO/FCRA Contract within the "Synergy Ceramics" programme in Japan)
Project Manager	Tekn dr Elis Carlström
Project 209	Net Shape Manufacture of Steel Parts by Water-based Forming and Liquid Phase Sintering (NETFORM) (EU Contract BRPR-CT98-0626 within the "Brite EuRam" programme)
Project Manager	Civ ing Ola Lyckfeldt
Project 258	Innovative Ultra-low Load/High Temperature/Creep-relaxation Free Static Seal (EU Contract G1RD-CT2000-00199 within the "Competitive and Sustainable Growth" programme)
Project Manager	Fil dr Kent Rundgren
Project 302	Nätverk för att förbättra verktygspressning av pulver med hjälp av datasimulering och andra avancerade tekniker (<i>Network to Improve Powder Die Compaction Using Computer Simulation and other Advanced Techniques</i>) (EU contract CTC1-2000-28046 within the "Competitive and Sustainable Growth" programme)
Project Manager	Tekn dr Elis Carlström
Project 310	Polar Electroceramics (EU Contract G5RT-CT-2001-05024 within Thematic Network)
Project Manager	Civ ing Jesper Brandt
Project 321	Capture of CO₂ in Coal Combustion (EU Contract 7220-PR-125 within the ECSC Core Research Programme)
Project Manager	Civ ing Lisa Palmqvist/Civ ing Sven Karlsson
Project 322	Grangemouth Advanced CO₂ Capture Project (EU Contract ENK5-CT-2001-005719)
Project Manager	Civ ing Lisa Palmqvist/Civ ing Sven Karlsson
Project 327	IRC West and South Sweden
Project Manager	Fil dr Kent Rundgren
Project 331	Automatic Quality Control for Industrial Printing (EU Contract G1RD-CT-2002-00783 within the "Competitive and Sustainable Growth" programme)
Project Manager	Civ ing Sven Karlsson

Other Projects

Project 124	Oxidation och gaskorrosion av keramer och keramkompositer för gasturbiner (<i>Oxidation and Gas Corrosion of Ceramics and Ceramic Composites for Gas Turbines</i>) (Nuteks kompetenscentrum "Högtemperaturkorrosion" vid CTH)
Project Manager	Docent Robert Pompe

Project 140	Keramiska monoliter för förbränningskatalysatorer vid höga temperaturer (<i>Ceramic Monoliths for High Temperature Combustion Catalysts</i>) (Energimyndigheten dnr 5310-99-947)
Project Manager	Civ ing Jesper Brandt
Project 201	Utveckling av piezoaktivt mikrosystem (<i>Development of a Piezoactive Microsystem</i>) (project within the Nutek "KOFUMA" programme, Nutek dnr 97-8240)
Project Manager	Civ ing Jesper Brandt
Project 226	Sintrade komponenter med hög densitet (VAMP 17). Delprojekt 2: Pressning och verktygsmaterial (<i>Sintered Components with High Density. Part 2: Pressing and Tool Material</i>) (Nutek dnr 1P10-98-05707)
Project Manager	Civ ing Birgitta Eyzop
Project 253	Unika komponenter i korta serier formade med pulver-teknik (<i>Unique Components in Short Series Shaped Using Powder Technology</i>) (<i>MARCHAL</i>)
Project Manager	Fil mag Mikael Eriksson
Project 259	Utbildningsprogram för Teknikmäklare (TUFF, Teknik-Utbyte För Företag) (Vinnova dnr 2001-06380)
Project Manager	Fil dr Kent Rundgren
Project 289	Mjukmagnetiska järnpulverkompositer i elmaskiner (VAMP 25) Experimentellt (<i>Soft Magnet Composites in Electrical Machines</i>) (Nutek dnr P14157-1)
Project Manager	Civ ing Birgitta Eyzop
Project 290	Mjukmagnetiska järnpulverkompositer i elmaskiner (VAMP 25) Administrativt (<i>Soft Magnet Composites in Electrical Machines</i>) (Nutek dnr P14157-1)
Project Manager	Tekn dr Eva Lidén
Project 291	Poltiles, EU 2355, Definitionsfasbidrag (<i>Poltiles, EU 2355, Definition Phase Allowance</i>) (Nutek dnr 1S31-00-05548)
Project Manager	Civ ing Sven Karlsson
Project 300	Sintrade komponenter med hög densitet (VAMP 17) – projektledning (<i>Sintered Components with High Density - Project Management</i>) (Nutek dnr P10-98-05707, P11580-1)
Project Manager	Tekn dr Elis Carlström
Project 304	Keramiska nanokompositer (<i>Engineering of Ceramic Nanocomposites</i>) (TFR dnr 97-775)
Project Manager	Tekn dr Elis Carlström/Tekn dr Eva Lidén
Project 308	New Material Basic Understanding (project within the OXIDE program "Keramiska oxider för högpresterande tillämpningar" Complex Oxide Materials for Advanced Devices, SSF Tvärvetenskapligt materialforskningsprogram)
Project Manager	Civ ing Jesper Brandt
Project 320	Strategisk vision för Keraminstitutet (Växtkraft) (<i>Strategic Visioning for SCI</i>) (Växtkraft Mål 3 (EFS-rådet) dnr 17456)
Project Manager	Tekn dr Elis Carlström

Project 326	Visoner, mål och roadmaps för materialområdet (Vinnova dnr 2002-01666)
Project Manager	Tekn dr Elis Carlström
Project 328	Teknikbevakning och omvärldsanalys av FoU-området “Dispergering av koncentrerade suspensioner” (delprojekt inom “Irecos stöd till kompetensutveckling”)
Project Manager	Civ ing Ola Lyckfeldt
Project 329	Teknikbevakning och omvärldsanalys av FoU-området “Avancerade skiktstrukturer” (delprojekt inom “Irecos stöd till kompetensutveckling”)
Project Manager	Civ ing Jesper Brandt
Project 330	Teknikbevakning och omvärldsanalys av FoU-området “Direktkonsolidering och friformsframställning” (delprojekt inom “Irecos stöd till kompetensutveckling”)
Project Manager	Tekn dr Erik Adolfsson

Personnel

Management

Roger Carlsson, Professor, Managing Director

Member of:

The Swedish Academy of Engineering Sciences, Dept V - Mining and Materials Technology

Secretary of:

The Swedish Ceramic Society

The Educational Committee of the Swedish Ceramic Society

Swedish representative in:

The Council of the European Ceramic Society

Adjunct professor in:

Ceramic Technology, Chalmers University of Technology

Research Management

Jesper Brandt, M Sc, Research Manager – Electroceramics, *tape casting, screen printing*

Elis Carlström, Ph D, R&D Manager

Member of:

European Powder Metallurgy Association (EPMA)

APMI International

The International Advisory Committee of the 8th International Conference on Ceramic Processing Science

Symposium organization for the American Ceramic Society Annual International Conference on Advanced Ceramic and Composites

Additional member of:

Jernkontoret TO80 Pulvermetallurgi styrelsen (Powder Metallurgy Board)

Sven Karlsson, M Sc, Research Manager – Traditional Ceramics, *porcelain, inorganic binders, mechanical properties*

SCI's representative in:

CER Labs – European Network of National Ceramic Laboratories

EUROLAB Sverige

Member of:

International Advisory Board CIMTEC 2002 Symposium B1

Eva Lidén, Ph D, Research Manager – Engineering Ceramics, Manager SCI Office Lund, *technology transfer, colloidal forming techniques*

Member of:

The Programme Board of MARCHAL, the Graduate School of Materials Science, Chalmers, Göteborg

Karin Lindqvist, M Sc, Quality Manager, *rapid prototyping, granulation*

Robert Pompe, Docent, *technology transfer, design and materials selection*

Project evaluator, 5th EU Framework Programme GROWTH

Swedish representative of:

Editorial Board, Journal of the European Ceramic Society

Supervisor of:

Postgraduate students in corrosion of ceramics, Dept of Environmental Inorganic Chemistry, CTH

Kent Rundgren, Ph D, Manager – Technology Transfer, *marketing*

Technology Broker (Diplomerad teknikmäklare) within Vinnova – TUFF Programme

Researchers

Erik Adolfsson, Ph D, *biomaterials*

Petrus Brännvall, M Sc, *sintering technologies, silicon nitride materials*

Monica Cristea, B Sc, *refractories, mechanical testing, extrusion*

Lars Eklund, specialist, *electron probe microanalysis, image analysis, SEM*

Cathrine Engebretsen, M Sc, *colloidal processing, tape casting*

Mikael Eriksson, M Sc, *biomaterials, forming methods*

Birgitta Eyzop, M Sc, *tribology, mechanical properties, compaction*

Daniel Käck, M Sc, *electroceramics, forming methods*

Ola Lyckfeldt, M Sc, *slip casting/pressure slip casting, new forming methods, rheology*

Lisa Palmqvist, M Sc, *colloidal processing, electroceramics, tape casting*

Technical Service & Administration

Bengt Ekeholt, maintenance work

Eva Freiholtz, lab assistant, laboratory work

Margareta Jansson, secretary, publications

Ulla-Britt Jigholm, secretary, economy

Axel Kristensson, B Sc, pressing, granulation

Martin Sjöstedt, engineer, equipment, injection moulding, process development

Eva Wallin, B Sc, colloidal forming techniques

Guest Researcher

Patricia Romano, University Carlos III, Madrid, Spain

M Sc Thesis Students

Hanna Asp, K – CTH, Göteborg

Cecilia Björström, K – CTH, Göteborg

Anna Bäckman, K – CTH, Göteborg

Fredrik Eriksson, K – CTH, Göteborg

Lectures and Courses

Lectures and poster presentations given by the SCI staff

Erik Adolfsson

Preparation of Designed Implants for Slow Release Using Slip Casting and Freeform Fabricated Moulds (poster), Bioceramics 15, Sydney, Australia 021204-08

Jesper Brandt

Piezokeramer – egenskaper och applikationer (Piezoceramics – Properties and Applications), lecture at the workshop on “The Electrical Properties of Ceramics in Advanced Applications”, Göteborg 021119

Roger Carlsson

Korrosion av keramer (Corrosion of Ceramics), lecture for dental technicians at the Faculty of Odontology, Göteborg University, Göteborg 020201

Keramer (Ceramics), presentation of Ceramics and the Swedish Ceramic Institute for the Board of Directors of IRECO, Stockholm 020531

Bränning av keramer inklusive glasyrer (Firing of Ceramics including Glazes), short course at the Swedish Ceramic Institute, Göteborg 021120

Keramer för tillämpningar inom livsmedel och bioteknik (Ceramics in Applications within the Food and Biotechnology Industries), lecture at the meeting of the Industrial Committee of the Swedish Institute for Food and Biotechnology, Göteborg 021129

Elis Carlström

Designing and Fabricating Pores in Porous Materials (invited lecture), The 26th Annual International Conference on Advanced Ceramics & Composites, The American Ceramic Society, Cocoa Beach, USA 020115

Influence of Humidity on Compaction of a Ceramic Powder, The 26th Annual International Conference on Advanced Ceramics & Composites, The American Ceramic Society, Cocoa Beach, USA 020116

Water-based Tape Casting with Latex Binders (invited lecture), The 26th Annual International Conference on Advanced Ceramics & Composites, The American Ceramic Society, Cocoa Beach, USA 020116

Binder Induced Porosity in Tape Casting, The 26th Annual International Conference on Advanced Ceramics & Composites, The American Ceramic Society, Cocoa Beach, USA 020117

Fabrication of Porous Oxide Structures (poster), 6th Synergy Ceramics Symposium, Nagoya, Japan 020131–0201

Ceramics, lecture at the course on “Materials Science for Biomedical Students”, Chalmers University of Technology, Göteborg 020211

Hands on Demonstration of Ceramics, lecture at the course “New Materials”, Linköping University, Linköping 020212

Konstruktion och Design (Construction and Design) lecture at the short course on “Nya prototypmetoder för keramer” (New Techniques for the Manufacture of Ceramic Prototypes) at the Swedish Ceramic Institute, Göteborg 020918

Influence on Humidity on Compaction of Ceramic Powders, DIENET (EU Network on Press Simulation), workshop, Crewe, UK 020926

Sven Karlsson

Fogning av keram till metall (Joining of Ceramic to Metal), Oorganiska förband (Inorganic Joints), Lödning av keram/metall eller keram/keram (Brazing of Ceramic/Metal or Ceramic/Ceramic), three lectures at the short course on "Fogning av keramer" (Joining of Ceramics) at the Swedish Ceramic Institute (arranged in collaboration with IVF), Göteborg 020417

Keramer som konstruktionsmaterial (Ceramics as Construction Materials), lecture at the course "Advanced Materials and Engineering", Halmstad University, Halmstad 021211

Karin Lindqvist

Porous Oxide Structures Processed by Indirect Solid Freeform Fabrication, 8th ICCPS, Hamburg, Germany 020905

"Rapid Prototyping" av keramer (Rapid Prototyping of Ceramics), lecture at the short course on "Nya prototypmetoder för keramer" (New Techniques for the Manufacture of Ceramic Prototypes) at the Swedish Ceramic Institute, Göteborg 020918

Ola Lyckfeldt

Si₃N₄ Powders Applied to Water-based DCT, The 104th Annual Meeting & Exposition of the American Ceramic Society, St. Louis, USA 020501

High Solids Loaded Si₃N₄ Suspensions for Water-based DCT, CIMTEC 2002, Florence, Italy 020716

Dispersing of Ceramic Powders at Extreme Solids Loading Applied for DCT and Tape Casting (poster), 8th ICCPS, Hamburg, Germany 020902-05

Direktkonsolidering – prototypmetod och tillverkning i mindre serier (Direct Consolidation Techniques – Techniques for the Manufacture of Ceramic Prototypes and Small Scale Production), lecture at the short course on "Nya prototypmetoder för keramer" (New Techniques for the Manufacture of Ceramic Prototypes) at the Swedish Ceramic Institute, Göteborg 020918

Kent Rundgren

Development of Water-based Processing of Silicon Nitride Materials, The 26th Annual International Conference on Advanced Ceramics & Composites, The American Ceramic Society, Cocoa Beach, USA 020117

R&D Activities at SCI, lecture at Nippon Steel Corporation, Futtsu, Japan 020219

Technology Transfer in Sweden and Ongoing R&D Work at SCI, lecture at Fukuoka University, Japan 020226

Si₃N₄ with Various Sintering Aids Produced by Freeze Granulation, Pressing and GPS, The 104th Annual Meeting & Exposition of the American Ceramic Society, St. Louis, USA 020501

Sintering Performance and Properties of Si₃N₄ Materials Shaped with Different Techniques, CIMTEC 2002, Florence, Italy 020718

Courses organised by SCI

Keramiska material (*Ceramic Materials*) (5 credit units) for K4, M4 and F4 students at Chalmers University of Technology, January – March 2002 (36 h lectures, 42 h lessons and laboratory lessons): 19 participants

A number of laboratory lessons and lectures in different courses at Chalmers University of Technology and the University of Göteborg

Short courses (one-day courses) organised by SCI

Fogning av keramer (*Joining of Ceramics*), a short course at the Swedish Ceramic Institute arranged in collaboration with IVF, Göteborg 020417: 17 participants

Nya prototypmetoder för keramer (*New Techniques for the Manufacture of Ceramic Prototypes*), a short course at the Swedish Ceramic Institute, Göteborg 020918: 6 participants

Bränning av keramer inklusive glasyrer (*Firing of Ceramics including Glazes*), a short course at the Swedish Ceramic Institute, Göteborg 021120: 14 participants

Workshop organised by SCI

Keramers elektriska egenskaper i avancerade applikationer (*The Electrical Properties of Ceramics in Advanced Applications*), workshop arranged in collaboration with SKF Prominent Needs Development, Göteborg 021118-19: 22 participants

Publications

Papers published in Scientific Journals and Conference Proceedings

Rundgren K and Lyckfeldt O

Development of Water-based Processing of Silicon Nitride Materials, Ceram. Eng. Sci. Proc., **23** [3] 3–10 (2002)

Carlström E and Kristoffersson A

Water-Based Tape Casting with Latex Binders, Ceram. Eng. Sci. Proc., **23** [4] 3–14 (2002)

Carlström E, Engebretsen C and Adolfsson E

Designing and Fabricating Pores in Porous Materials, Ceram. Eng. Sci. Proc., **23** [4] 235–245 (2002)

Engebretsen C and Carlström E

Binder Induced Porosity in Tape Casting, Ceram. Eng. Sci. Proc., **23** [4] 253–259 (2002)

Lyckfeldt O and Rundgren K

High Solids Loaded Si₃N₄ Suspensions for Water-based DCT. In Proceedings of 10th International Ceramics Congress (CIMTEC 2002) – Part A, Techna Srl, Faenza (2002)

Rundgren K and Lyckfeldt O

Sintering Performance and Properties of Pressed Si₃N₄ Materials. In Proceedings of 10th International Ceramics Congress (CIMTEC 2002) – Part B, Techna Srl, Faenza (2002)

Bowden M and Lyckfeldt O

A Comparison of Potato and Corn Starch for Consolidation of Concentrated Zirconia Suspensions, pp. 69–74 in Shaping II, Proceedings of the Second International Conference on Shaping of Advanced Ceramics, eds. J Luyten and J-P Erauw, Vito, Belgium 2002

MSc Theses

Cecilia Björström

Porous Oxide Structures Processed with Indirect Solid Freeform Fabrication, MSc Thesis, Chalmers University of Technology, Göteborg, 2002

Anna Bäckman

Development of Ultra-low Thermal Expansion Ceramic Composites with High Stiffness, MSc Thesis, Chalmers University of Technology, Göteborg, 2002

Fredrik Eriksson

Sintering Studies of Large Grained Silicon Carbide for 2nd Generation Diesel Particulate Filters (DPF), MSc Thesis, Chalmers University of Technology, Göteborg, 2002

Jimmy Nilsson

Silicon Nitride with High Thermal Conductivity, MSc Thesis, Chalmers University of Technology, Göteborg, 2001

Equipment

SCI has various equipment and instruments for the manufacture and analysis of ceramic materials. The equipment covers all steps in the manufacturing process, from the powder processing to the machining of finished products as well as analysis of the physical, chemical and mechanical properties of ceramic materials. The institute continually tries to update the instrumentation always to have modern and up-to-date instruments available.

Analysis of Microstructure

JEOL, JSM-5300, scanning electron microscope
 JEOL, JXA-8600, electron probe micro analyser
 Kontron, image analyser
 Philips, X-ray diffractometer
 Leica, inverted microscope

Mechanical Testing

ASCERA, hydraulic tensile tester
 Åbo Akademi, tensile tester for fibres
 Zwick, universal mechanical tester, 50 kN
 Controls, compressive tester, 500 kN
 SCI, stepped temperature stress rupture tester (STSR), 1500°C
 Zwick, microhardness tester
 Zwick, hardness tester (plaster, polymers etc)
 Zwick, impact tester
 Tonindustrie, impact tester for tableware
 SCI, friction and wear tester
 SCI, glaze metal marking tester

Machining

Profila, surface grinder
 Solectro, CNC equipment – green machining
 Solid Works, 3D CAD program
 Various cutting machines and equipment for the preparation of test specimens

Manufacture of Ceramics

AMI, screen printer CP-885
 Pasadena Hydraulics, multilayer press 100 ton
 LPKF Laser & Electronics, circuit board plotter promat C60
 Retsch, planetary mill
 Büchi, evaporator
 Cole-Parmer, ultrasonic homogeniser
 Various mills, sieves and presses
 Loomis, cold-isostatic press
 Hubanith, hydraulic powder press, 100 ton
 Brabender, kneading mixer
 Wallace, tape caster

Netzsch, pressure caster
 Büchi, mini spray drier
 ModelMaker, Solid Freeform Fabrication Equipment
 Leybold, freeze drier
 SCI, freeze granulator
 Pfeiffer, graphite resistance furnace, 2200°C
 Rühstrat, graphite resistance furnace, 2500°C
 FCT, gas pressure sintering furnace, 10 MPa, 2000 °C
 Entech, Superkanthal furnace, 1700°C
 Lindberg, Superkanthal furnace, 1700°C
 Entech, Superkanthal furnace (top-hat type), 1800°C
 Various furnaces for maximum 1500–1700°C
 Termaks, climate chamber

Process Analysis

Repab, electrophoretic mobility tester
 Micromeritics, Sedigraph, particle size distribution analyser
 ♦ Micromeritics, BET specific surface area analyser
 Micromeritics, mercury porosimeter
 Micromeritics, He pycnometer for density measurements
 Radiometer, conductivity meter
 Contraves, viscosimeter
 RheoLogica, CS rheometer
 Mettler, moisture content meter
 Jouan, centrifuge
 SCI, equipment for rate controlled binder removal
 Mettler, DTA and TGA, 1600°C
 Harrop, TGA, 1600°C
 Harrop, DTA, 1600°C
 Harrop, dilatometer, 1600°C
 Masstorr, mass spectrometer

♦ Instruments acquired during 2002.

The Industrial Ceramic Research Association

Föreningen för Industriell Keramforskning

Members in the Industrial Ceramic Research Association during 2002

Allgon System AB, Täby, Sweden
Astra Tech AB, Mölndal, Sweden
BioMat System AB, Stockholm, Sweden
BodaNova Höganäs Keramik AB, Höganäs, Sweden
CC Höganäs Byggkeramik AB, Ekeby, Sweden
Creator Teknisk Utveckling AB, Borlänge, Sweden
Designor AB, Lidköping, Sweden
Doxa AB, Uppsala, Sweden
Eka Chemicals AB, Bohus, Sweden
Ericsson AB, Stockholm, Sweden
Finnveden Powertrain AB, Moheda, Sweden
Goceram AB, Mölndal, Sweden
AB Gustavsberg, Gustavsberg, Sweden
Höganäs AB, Höganäs, Sweden
Ifö Ceramics AB, Bromölla, Sweden
Ifö Electric AB, Bromölla, Sweden
Inficon Aaland Ab, Mariehamn, Finland
Jämtlands Utvecklingsbolag AB, Lit, Sweden
Kanthal AB, Hallstahammar, Sweden
Keranova AB, Upplands Väsby, Sweden
Lafarge Svenska Höganäs AB, Höganäs, Sweden
LGP Telecom AB, Solna, Sweden
LightLab AB, Göteborg, Sweden
Maxitech Elektronik AB, Åkersberga, Sweden
Nobel Biocare AB, Göteborg, Sweden
Nobel Biocare Procera AB, Stockholm, Sweden
Permascand AB, Ljungaverk, Sweden
Piezomotor Uppsala AB, Uppsala, Sweden
PowderPro Göteborg HB, Göteborg, Sweden
Saab Ericsson Space AB, Göteborg, Sweden
AB Sandvik Coromant, Stockholm, Sweden
Scania AB, Södertälje, Sweden
SKF Sverige AB, Göteborg, Sweden
SlipNaxos AB, Västervik, Sweden
Tetra Pak R&D AB, Lund, Sweden
Volvo Aero Corporation, Trollhättan, Sweden
Volvo Materialteknik AB, Göteborg, Sweden