Introduction to the SurfEnergy, Ionmet and ProSurf projects

Pete Starkey, EIPC

New Developments in PCB and Interconnect Manufacturing
Rotherham, 4th August 2009
Global PCB Industry: Fabrication by Region

2008 estimate $48.580M

- America: 4.210 (8.6%)
- Europa: 3.380 (7.0%)
- RoW: 240 (0.5%)
- China: 14.920 (83.9%)
- Korea: 5.160
- Taiwan: 6.840
- OAS: 3.270
- Japan: 10.560

SurfEnergy
IONMET
Pro Surf
EU
CIPC
Global PCB Industry: Fabrication by Region

- Asia 83.9% $40,758M
- North America 8.6% $4,210M
- Europe 7.0% $3,380M
- RoW 0.5% $240M
European PCB Industry Trend

- Approx 400 companies producing PCBs
- Approx 20000 people employed
- Most companies classified as SME
PCB Fabricators in Europe

Belgium: 7
Czech Republic: 9
Denmark: 8
Germany: 78
Estonia: 3
Spain: 21
Finland: 10
France: 45
Ireland: 2
Italy: 59
Macedonia: 9
Netherlands: 6
Norway: 3
Austria: 5
Poland: 22
Portugal: 4
Slovakia: 2
Switzerland: 17
Sweden: 12
United Kingdom: 55
European PCB Fabricators by Turnover

Approx 400 Fabricators (VdL)

- 6% < $1.5M
- 16% $1.5M – $7.5M
- 34% $7.5M - $25M
- 44% > $25M
The PCB market in Europe is not a growth market.

Fabrication costs for large series are very high in Europe compared with Asia.

Design and development continues in Europe.

Prototype and pre-production orders are manufactured in Europe (but for how long, and at what cost?).

New technologies need to continue to be introduced in Europe to gain or maintain technology leadership.

Europe must take the opportunity to get into a leading position when writing new standards.
What is needed to support ongoing PCB Production in Europe?

- Faster realization of new projects
  - Time to market
- Environmental safe PCB fabrication processes
  - Lead free
  - REACh
- Lower cost fabrication technology
  - To maintain competitive advantages versus non EU fabricators
- New PCB fabrication technologies with the capability to drive innovation and lower unit cost
How Can the European Commission Help SMEs?

Mission of the Research Directorate-General:

• to develop the European Union’s policy in the field of research and technological development and thereby contribute to the international competitiveness of European industry

• to coordinate European research activities with those carried out at the level of the Member States

• to support the Union’s policies in other fields such as environment, health, energy, regional development etc

• to promote a better understanding of the role of science in modern societies and stimulate a public debate about research-related issues at European level
Based on the Treaty establishing the European Union, the Framework Programme has to serve two main strategic objectives:

- Strengthening the scientific and technological bases of industry and encourage its international competitiveness
- Promoting research activities in support of other EU policies
The Sixth Framework Programme (FP6) was the Union’s main instrument for the funding of research in Europe for the period 2002 to 2006, and covered Community activities in the field of research, technological development and demonstration (RTD).

Main focus of FP6 was the creation of a European Research Area as a vision for the future of research in Europe.

Aimed at scientific excellence, improved competitiveness and innovation through the promotion of increased cooperation, greater complementarity and improved coordination between relevant actors, at all levels.
The Seventh Framework Programme (FP7) is the current EU programme for research and technological development for the period 2007 to 2013.

The proposal provides new impetus to increase Europe's growth and competitiveness, recognising that knowledge is Europe's greatest resource.

The programme places greater emphasis than in the past on research that is relevant to the needs of European industry, to help it compete internationally, and develop its role as a world leader.
SurfEnergy, Ionmet and ProSurf projects and the role of EIPC

- **SurfEnergy**: Advanced Tools for Surface Finishing Processes to Optimise Energy Efficiency (New)
- **IONMET**: New Ionic Liquid Solvent Technology to Transform Metal Finishing (Ongoing)
- **ProSurf**: Promotion and Support of SME Research and Innovation in the Surface Finishing and Printed Circuit Manufacturing Sectors (Concluded)
- **EIPC**: To disseminate knowledge and technical information to the European PCB industry
SurfEnergy Project

• A new project under FP7, supported by Intelligent Energy Europe
• Commenced 01/09/2008
• To be concluded 31/08/2011
• To promote the introduction of energy efficiency measures by SMEs in the Surface Finishing and Printed Circuit manufacturing industries
SurfEnergy: Project Title and Partners

Advanced Tools for SURFace Finishing Processes to Optimise ENERGY Efficiency

- C-Tech Innovation (UK)
- BESEL (Spain)
- Env-Aqua Solutions (UK)
- EIPC (Netherlands)
- UITS (France)
- Protection des Métaux (France)
SurfEnergy: Project Objectives

To overcome the key barriers:

- Increasing the awareness of manufacturing companies to the possibility of introducing energy management systems and the potential benefits that could result

- Providing options for energy efficiency solutions to manufacturing companies, based on analysis and detailed understanding of the generic production processes currently in use
SurfEnergy: Main Project Outputs

• Software toolkit for Energy Efficiency solutions and benchmarking
• Intelligence on energy implications of new technologies
• Integration of Energy Efficiency and Environmental needs
• Financial guidance on capital expenditure for equipment options and operating costs for process options
SurfEnergy: Main Project Outputs (continued)

- Environmental impact via streamlined Life Cycle Analysis assessment
- Roap mapping to facilitate strategic planning in future research and development with the potential to increase energy efficiency
- SME end-user applications testing for the energy efficiency toolkit
SurfEnergy: Initial Achievements

• Main activity over the first 6 months has been technical assessment of energy saving possibilities in Surface Finishing and Printed Circuits.

• Comprehensive list of manufacturing processes compiled and savings grouped into generic categories: Process improvement; Retrofit of more efficient equipment; Waste reduction in existing processes; New processes; Research developments.

• www.surfenergy.eu
IONMET Project

• A 4-year project under FP6
• To be concluded 31/12/2009
• To develop radical new metal finishing technologies based on ionic liquid solvents.
IONMET: Primary Objectives

• To introduce and promote technical applications of Ionic Liquids as nonaqueous electrolytes in the field of metal finishing:
  • To improve the potentials of electropolishing, plating and surface structuring
  • To increase the range of metals available for deposition
  • To develop new applications of surface finishing
  • To enhance environmental sustainability
  • To develop standard operating procedures for the use of Ionic Liquids in practice
IONMET: Project Title and Partners

New Ionic Liquid Solvent Technology to Transform Metal Finishing Products and Processes

33 Project Partners from 11 EU Countries, including University of Leicester and PW Circuits in UK

EIPC have responsibility to disseminate knowledge and technical information to the European PCB industry
What are Ionic Liquids?

Ionic liquids are room temperature fluids composed entirely of ions, typically large organic cations and small inorganic anions. The thermodynamics and reaction kinetics of processes carried out in ionic liquids are different from those in conventional media. This creates new opportunities for catalytic reactions, separations, electrochemistry, and combined reaction/separation processes. Ionic liquids have no detectable vapor pressure and do not emit volatile organic compounds (VOCs), providing a basis for clean manufacturing – “green chemistry.”
Ionic Liquid Characteristics

- “Designer Solvents”
- New class of electrolytes with unusual properties.
- Enable the electrodeposition of metals which cannot be deposited from aqueous electrolytes like aluminium, titanium or tantalum,
- Eco-friendly: No vapour pressure, therefore no VOCs
Properties of IONMET Chemistry

The chemistry developed under IONMET:

• Is environmentally safe
• Works in a close to neutral pH
• Easy waste water and waste treatment
• Can be recycled
• Is suitable for electroless metal deposition processes
• Provides an option to develop additive fabrication processes using Permanent Additive Resists (PAR)
Example of Ionic Liquid Chemistry

Choline chloride (2-hydroxy-N,N,N-trimethylethanaminium chloride) – mass produced as a growth additive for chicken feed

+ 2 Ethylene glycol

= “Ethaline”

Deep Eutectic Solvent

Readily dissolves metal chlorides (eg Silver Chloride)
IONMET Immersion Silver

- Creep corrosion, solder mask interface corrosion (crevice corrosion), associated with immersion silver chemistries based on nitric acid
- IONMET Immersion Silver: non-aqueous, non-toxic, non-corrosive, neutral process
- Nano-structured deposit
- Laboratory facility at University of Leicester
- Pilot plant facility being commissioned at PW Circuits
- Will be available for sample processing
Future Scope for IONMET

- 75 µm line/space achieved in 1986 by full additive technology using permanent additive resists (PAR)
- Ban on chlorinated and fluorinated solvents stopped the use of solvent photoresists.
- Aqueous photoresists not compatible with highly alkaline electroless plating chemistry
- Ionic liquids, as developed under the IONMET program, could re-open the door for additive technology using permanent additive resists.
ProSurf Project

- A 3-year project under FP6
- Project now concluded
- Commenced 01/09/2005
- Concluded 31/08/2008
ProSurf: Project Title and Partners

The Promotion and Support of SME Research and Innovation in the Surface Finishing and Printed Circuit Manufacturing Sectors

- C-Tech Innovation (UK) (Co-ordinator)
- DGO (Germany)
- EIPC (Netherlands)
- RTC North (UK)
ProSurf: Targets and Objectives

- Target sectors are Surface/Metal Finishing and Printed Circuit Board (PCB) manufacturing, which are traditional SME intensive industries with similar and overlapping technological needs.
- Objective of increasing involvement in framework programme research, particularly emerging and future European RTD activities and programmes
- Central project aims:
  - Analysis and benchmarking of sectoral technological and business/market needs
  - Integration of SME sectoral research needs through exchange and dissemination of information and networking
  - Facilitation of SME innovation in target sectors by establishing best practice
ProSurf: Mission of the Technology Roadmap

“To guide manufacturing, process, material, equipment and product research and development in order to establish and maintain leadership in electronic interconnection technology; integrate the development of new and innovative solutions with partners in the electronics industry, academia and government; and excel in the global market by implementing these developments and continuously improving customer satisfaction.”
ProSurf – What has EIPC Contributed?

- Report on international standards
- Report on how the industry is responding to legislation: WEEE, RoHS, REACh
- Report on emerging technologies
- Road map for the printed circuit industry, providing the current and future analysis of technical and market trends
- Programme of dissemination and training activities
- Dedicated section of EIPC website
ProSurf Road Map

Dissemination of information concerning PCB technology and surface finishes

**European Printed Circuit Technology Road Map 2007 - 2017**

With particular emphasis on Small-to-Medium Enterprises

Project no. 023270

“ProSurf”
Deliverable D7
Road Map Defining Future Research Strategy

Due date of deliverable: Month 21
Actual submission date: August 31, 2007
Start date of project: 01/09/2006
Duration: 36 Months

Organization name for dissemination of information in the PCB Industry: EIPC

Promotion and Support of SME Research and Innovation in the Surface Finishing and Printed Circuit Manufacturing Sectors

134 pages

Copies available from EIPC
European industry has major opportunities to receive EU funding for R&D activities

- Industry and the academia world should partner on meaningful programs that will help Europe to maintain or expand industrial leadership
- The EIPC and its member companies are in a position to help defining meaningful projects and finding partners for cooperation
- It is important that the projects are professionally managed by using Cluster Management Technology
- Measurable results have to be achieved
Thank you all for your attention

for further information, see

www.eipc.org
www.surfenergy.eu
www.ionmet.eu
www.prosurf-online.eu