

# Jim Thomason - Background

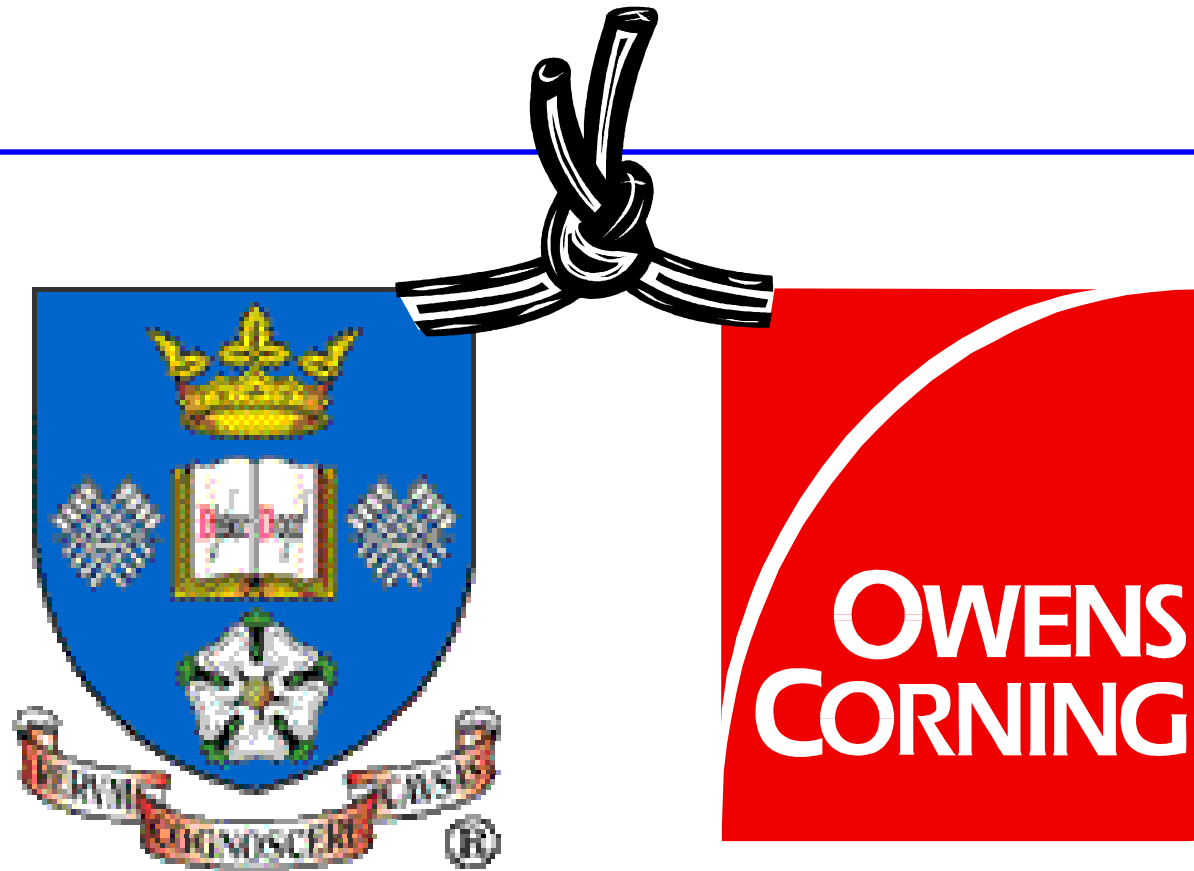
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- **2007 - Professor of Advanced Materials & Composites, Univ. Strathclyde**
- **2003 - Visiting Professor, Univ. Sheffield, Dept. Eng Materials**
  
- **1996-2006 Owens Corning Science & Technology, USA & Belgium**
  - New Product development and fundamental research – composites & fibres.
  - Chair of 2004 Gordon Research Conference on Composites
- **1983-96 Shell Research, Amsterdam,**
  - Exploratory Research & Product Development –Polymers , Composites, Interfaces
  
- **1982-3 Mainz, Germany, Postdoc - polymer blends**
- **1981 Strathclyde PhD – Interphase in multiphase polymers.**
- **1977 Edinburgh BSc – Physics,**

# Jim Thomason - Research Interests

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- **Interfaces in High Performance Composites**
- **Natural fibre reinforced polymer composites**
- **Structure-Processing-Performance in Fibre Reinforced Thermoplastics**
- **Reinforcements - surface and microstructure**
- **Application of Molecular Modeling to Materials**



***Making the University-Industry  
(Composite) Interface Work***

*Jim Thomason*

# Content

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- Introduction

- Does the materials industry support fundamental research ?

- Getting Support from Industry (an example)

- Results

- Were we successful ?

- Conclusions -


- What have we learned ?

# Does the materials industry support fundamental research ?

- It Depends
  - Which Company ?
  - Who are you talking with ?
- In General
  - Product cycle times are becoming shorter
  - Financial considerations are becoming more influential
- Therefore – fundamental research is becoming more difficult to justify within the current business climate

# Does the materials industry support fundamental research ?

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- However – at the same time
  - Customers demand more (productivity & performance)
  - Many (composite) products are high on the S-curve of the development cycle = less improvement for more effort
  
- One solution is to innovate more
  - Innovation by serendipity 
  - New knowledge based Innovation
  
- Therefore – more fundamental insights are required

# Product development & fundamental research



- Industry may support fundamental work which:
  - Reduces cost, time and waste to manufacture an existing product
  - Reduces cost and time to develop a new product
  - Improves quality
  
- Industry is less likely to support fundamental work which
  - Results in incremental performance improvements

# **Industrial Support for University Research Programmes**

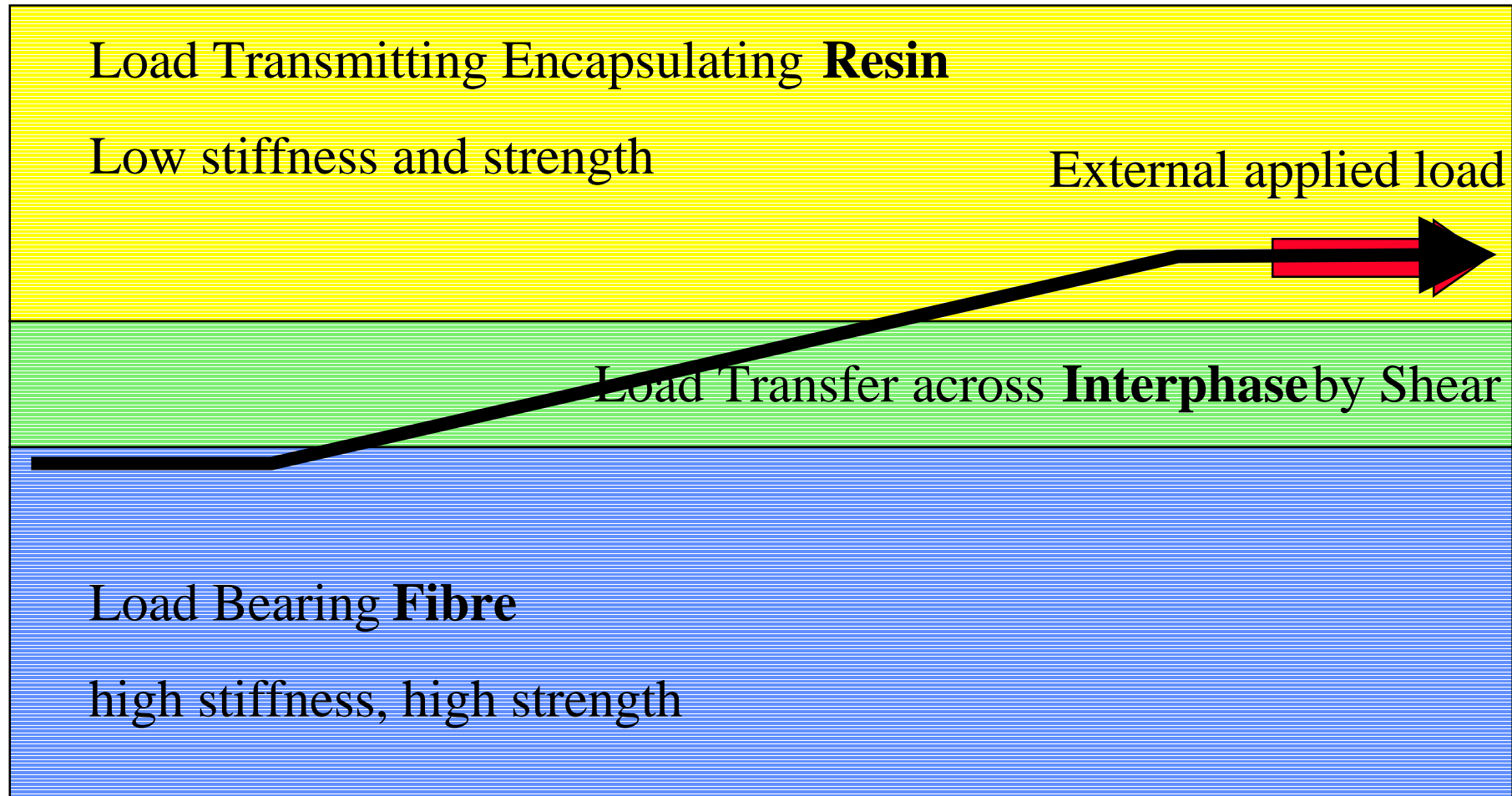
**An example of how to get  
some support**

# How Does OC make (*more*) Money ???

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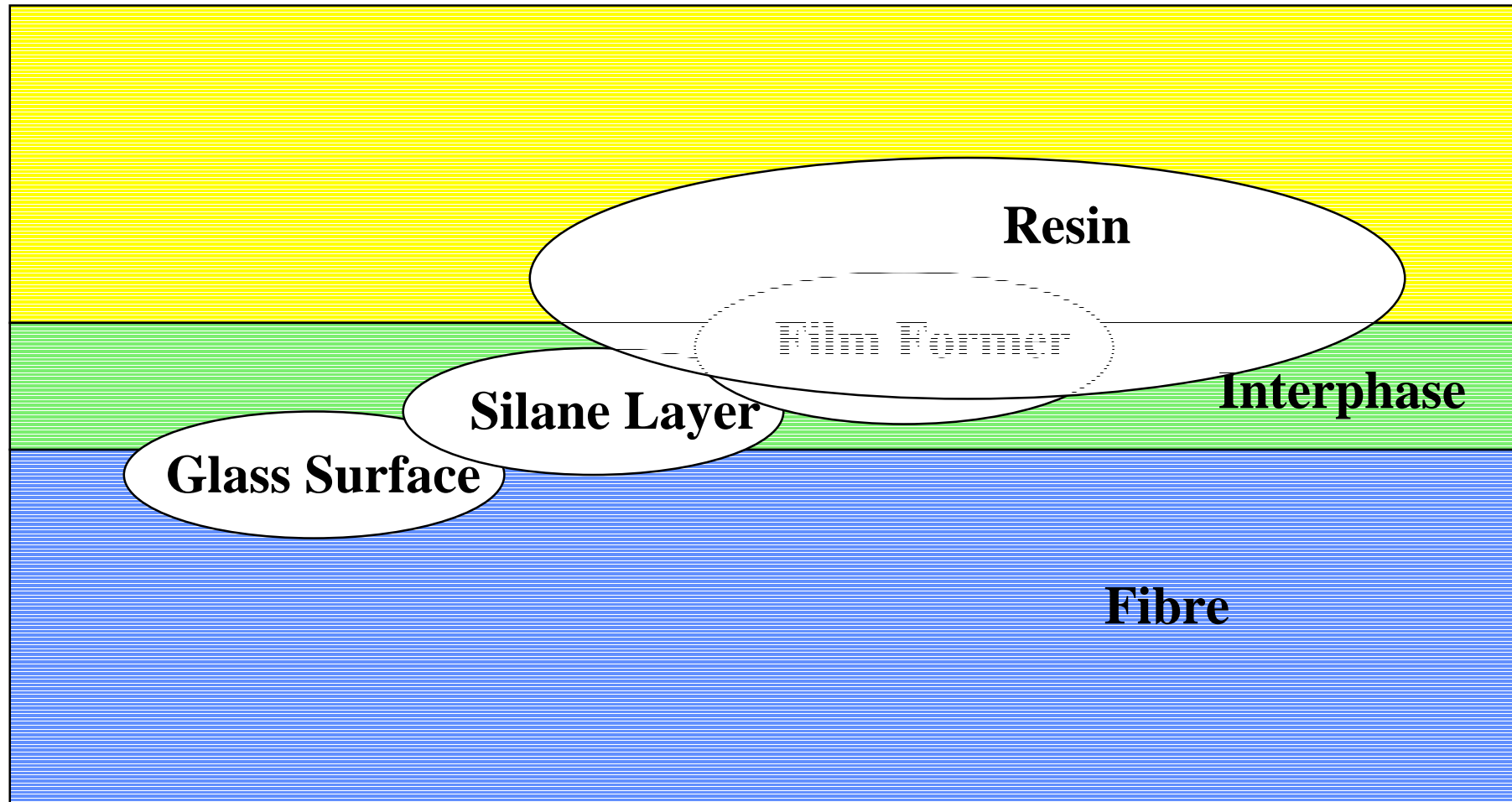
- You sell (*more*) reinforcements for composite materials
- So you need to produce good (*better*) reinforcement products
- So you need to understand (*better*) what reinforcements do (*for your customers*)
- So how does fibre reinforcement work ???

# How does fibre reinforcement work ?



A “good” interphase is critical to nearly all composite performance criteria

# What do we need to understand (better) ?



**New Insights**  **New Product Innovations**

# The Results

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## ■ Were we successful ?


### – Owens Corning supports

- *PhD Project 1 - X.Liu 10/2003-9/2006*
- *PhD Project 2 - C. Wang 10/2005-9/2008*
- *Post Doc Project - X. Liu 10/2006-9/2007*

# Conclusions - What have we learned ?

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## ■ Academia

- *Be flexible on IP*
- *Plan for some changes in direction (in a 3 year project)*
- *Clear unambiguous results (with confidence limits)* 

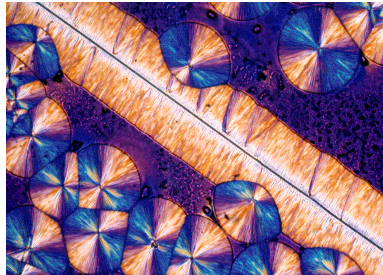
## ■ Industry

- *Be flexible on publications*
- *Ensure the research results will still be relevant in 3 years*
- *Be (reasonably) patient*

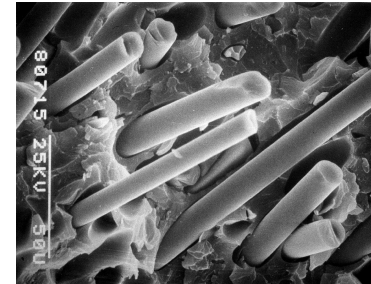
## ■ Communication is key

- *Frequent*
- *Appropriate Level of Detail*

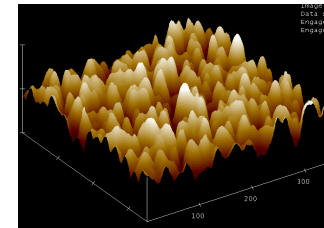
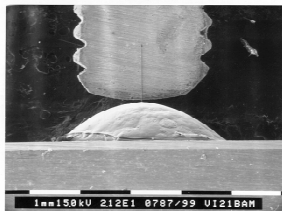
# Composites Knowledge Resource



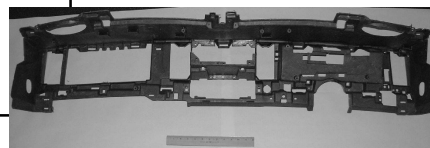
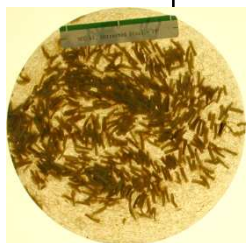
**Thermoplastic  
Composites Structure-  
Process-Performance**



**Surface &  
Interface  
Micromechanics**



**Composites  
based on  
Sustainable  
Materials**



**Composites  
for Wind  
Energy**





# The Challenge of New Product Development

- **Results! Why, man, I have gotten a lot of results. I know several thousand things that won't work.**
  - **Thomas A. Edison (1847 - 1931)**
- **Industry can no longer afford to waste resources doing it this way**
- **Need better understanding and insights to guide more efficient product development programs with higher probability of success**



# XPS data - 2 Spectrometers

## 1% APS coated Advantex fibres (Daresbury)

	TOA	C	Si	O	Ca	Al	Mg	Na	N	C/Si	C/N	Si/N	O/Si
As coated	25	23.9	20.9	45.9	3.0	3.9	0.0	0.0	2.4	1.1	9.9	8.7	2.2
	45	15.2	21.4	53.6	4.2	4.1	0.0	0.0	1.5	0.7	10.1	14.3	2.5
	90	9.6	21.1	58.6	5.3	4.5	0.0	0.0	0.9	0.5	10.7	23.4	2.8
WWE	25	24.9	18.8	46.9	3.3	4.5	0.0	0.0	1.6	1.3	15.6	11.8	2.5
	45	17.1	19.2	53.3	4.3	5.4	0.0	0.0	0.7	0.9	24.4	27.4	2.8
	90	8.4	20.1	59.9	5.3	5.6	0.0	0.0	0.7	0.4	12.0	28.7	3.0
HWE	25	26.3	20.0	43.4	3.1	5.4	0.0	0.0	1.8	1.32	14.6	11.1	2.2
	45	21.5	18.9	50.8	3.7	4.3	0.0	0.0	0.8	1.14	26.9	23.6	2.7
	90	9.9	19.3	59.1	5.2	5.8	0.0	0.0	0.7	0.51	14.1	27.6	3.1

## 1% APS coated Advantex fibres (Sheffield)

	TOA	C	Si	O	Ca	Al	Mg	Na	N	C/Si	C/N	Si/N	O/Si
As coated	25	24.8	19.2	46.1	2.8	3.8	0.4	0.3	2.8	1.3	9.2	7.1	2.4
	45	20.0	19.4	50.3	3.4	4.0	0.0	0.6	2.5	1.0	8.2	7.9	2.6
	90	16.3	18.1	54.4	3.9	3.9	0.7	0.6	2.3	0.9	7.1	7.9	3.0
WWE	25	26.1	18.2	46.1	2.8	4.7	0.0	0.0	2.2	1.4	11.9	8.3	2.5
	45	20.2	18.9	50.7	3.3	4.3	0.8	0.2	1.9	1.1	10.9	10.2	2.7
	90	17.0	17.8	53.6	3.8	4.7	1.0	0.3	2.0	1.0	8.7	9.2	3.0
HWE	25	22.2	19.3	48.7	2.9	4.6	0.0	0.0	2.5	1.1	9.1	7.9	2.5
	45	17.4	18.7	52.8	3.3	4.9	0.8	0.0	2.3	0.9	7.8	8.4	2.8
	90	14.9	17.9	56.1	4.0	4.3	0.7	0.2	2.0	0.8	7.5	9.0	3.1

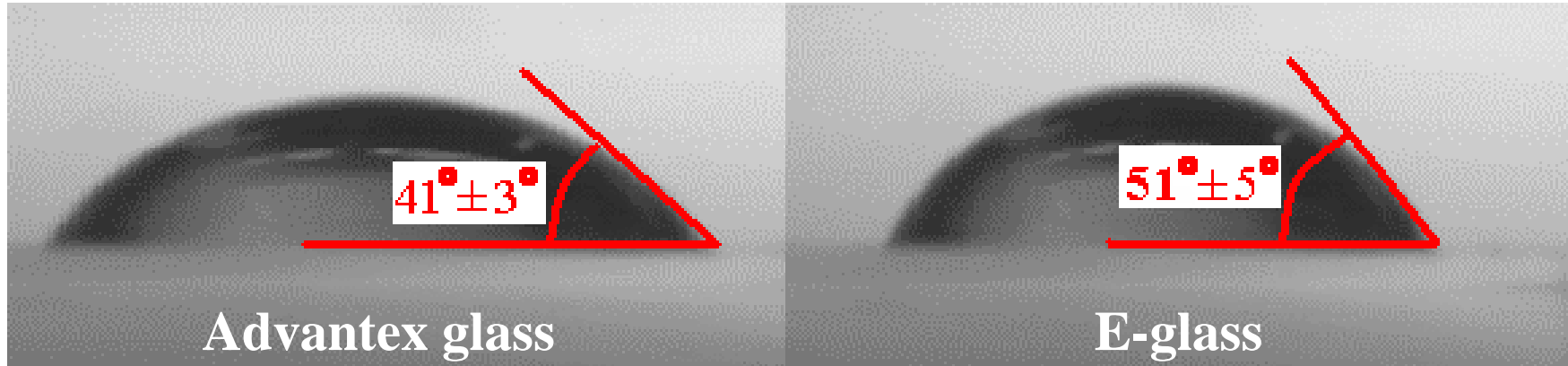
## 1% APS coated E-glass fibres (Daresbury)

	TOA	C	Si	O	Ca	Al	Mg	Na	N	B	C/Si	C/N	Si/N	O/Si
As coated	25	30.9	17.4	39.0	2.3	3.3	1.0	0.0	3.6	2.5	1.8	8.6	4.8	2.2
	45	19.7	17.6	48.5	3.5	4.8	0.6	0.0	2.4	2.9	1.1	8.2	7.3	2.8
	90	19.4	17.0	50.4	3.6	4.5	1.2	0.0	1.7	2.2	1.1	11.4	10.0	3.0
WWE	25	33.9	15.1	41.5	2.1	3.3	0.0	0.0	2.5	1.6	2.2	13.6	6.0	2.7
	45	24.4	16.0	47.2	3.5	4.5	1.2	0.0	1.4	1.8	1.5	17.4	11.4	3.0
	90	12.5	17.7	54.4	4.0	5.6	1.1	0.0	1.1	3.6	0.7	11.4	16.1	3.1
HWE	25	17.2	18.5	50.6	2.6	5.7	1.4	0.0	2.3	1.7	0.9	7.5	8.0	2.7
	45	12.5	18.9	55.3	3.4	5.7	0.9	0.0	1.0	2.3	0.7	12.5	18.9	2.9
	90	7.6	18.4	60.6	3.8	5.5	0.9	0.0	0.8	2.4	0.4	9.5	23.0	3.3

## 1% APS coated E-glass fibres (Sheffield)

	TOA	C	Si	O	Ca	Al	Mg	Na	N	B	C/Si	C/N	Si/N	O/Si
As coated	25	23.0	17.7	47.2	2.3	4.2	0.3	0.0	3.3	2.2	1.3	7.0	5.4	2.7
	45	17.1	17.3	51.4	2.8	4.9	1.1	0.2	2.7	2.8	1.0	6.5	6.5	3.0
	90	14.2	16.4	55.9	3.3	4.7	1.1	0.4	2.1	2.2	0.9	6.9	8.0	3.4
WWE	25	28.3	16.9	44.2	2.0	5.4	0.6	0.0	2.8	0.0	1.7	10.4	6.2	2.6
	45	22.4	16.1	48.4	2.4	5.4	0.9	0.0	2.6	2.0	1.4	8.8	6.3	3.0
	90	19.6	15.7	51.9	2.8	4.7	1.1	0.0	2.4	2.1	1.2	8.3	6.7	3.3
HWE	25	24.3	16.4	46.7	2.3	5.5	1.0	0.0	2.7	1.4	1.5	9.1	6.2	2.9
	45	20.4	16.6	50.8	2.7	5.0	1.1	0.0	2.4	1.1	1.2	8.9	7.2	3.1
	90	18.1	15.8	53.4	3.0	4.8	0.9	0.0	2.1	2.2	1.1	8.8	7.8	3.4

# Contact Angle, water on glass slides



- Advantex is more hydrophilic than E-glass.
- Glass surface chemistry is different.
- Advantex surface had more polar (hydroxyl) groups than E-glass.

## Why is this important ???

-OH groups are the principal sites for adsorption of, and reaction with, water and sizing molecules

