The Gordon Laboratory

Open Day & Kelly Lecture

Thursday 12th June 2003

1.00-7.00pm	Poster Display (Babbage Podium)
1.30-2.00pm	Registration (Babbage Podium)
2.00-3.30pm	The Gordon Seminars (Babbage Lecture Theatre)
3.30-4.00pm	Tea & Coffee (Babbage Podium)
4.00-5.00pm	The Gordon Seminars (Babbage Lecture Theatre)
5.00-5.30pm	Tea, Coffee & Biscuits (Babbage Podium)
5.30-6.30pm	The Kelly Lecture (Babbage Lecture Theatre)

The Gordon Seminars

Session 1 Chairman: Prof. T.W.Clyne

2.00-2.30pm: Prof H.K.D Bhadeshia
"Extremely Strong and Tough Steels "

We have recently discovered that it is possible to create an incredibly fine microstructure in steel by phase transformation at a temperature as low as 150°C. To put this into context, the diffusion distance of an iron atom at this temperature is only 10^{-17} m over a period of three weeks.

This has the consequence that the crystals that form are incredibly fine, 20-40 nm thick, making the material very strong (> 2500 MPa). Better still, the crystals are separated by a ductile phase which makes it possible to create strong *and* tough alloys. All this can be achieved in very large samples without recourse to vigorous heat-treatments or complex processing. The alloys are at the same time cheap and easy to manufacture. The hardness can routinely exceed 650 HV.

2.30-3.00pm: Prof M. Ward-Close, QinetiQ Ltd.
"Titanium, a Metal Comes of Age "

Titanium is shaking off its traditional image as an 'exotic' material and starting to find its way into everyday applications, such as golf clubs and watch cases. Titanium has similar properties to stainless steel at nearly half the weight and better corrosion resistance. However, cost is the key to expansion into bulk markets like automotive and general engineering. This paper will present some exciting new applications and developments in the titanium world. New technology in extraction and processing of titanium alloys is likely to bring substantial changes to the titanium industry in the near future, and these developments will be discussed in detail.

3.00-3.30pm: Prof I.M. Hutchings
"Wear as a Manufacturing Process."

Wear is commonly seen as a process of material degradation, but the underlying mechanisms can also be usefully employed in various methods for changing the geometry or surface topography of components. These opportunities will be reviewed and wear processes compared and contrasted with mechanical methods of surface treatment.

Session 2 Chairman: Prof A.L. Greer

4.00-4.30pm: Prof C.J. Humphreys
"Super-efficient Lighting for the 21st Century."

Thomas Edison's light bulb, invented over 100 years ago, is living on borrowed time. Super-efficient solid state lighting, based on the new material gallium nitride, may well replace all the light bulbs and fluorescent tubes in the world, a market of £12 billion per year. The Cambridge Centre for Gallium Nitride, a partnership between the Cambridge Materials Department and Thomas Swan, is already growing very bright gallium nitride LEDs.

This talk, which will be illustrated with demonstrations, will describe recent achievements and research challenges. Red LEDs are 25 times as efficient as red light from light bulbs. The best white LEDs have about the same efficiency as light bulbs. However if we can double the efficiency of white LEDs, which needs further research, and use these in home and office lighting, we would save 10% of all UK electricity consumption, reduce CO_2 emissions by 10%, and be able to close five medium sized power stations. The potential for at least doubling the efficiency of white LEDs is high.

4.30-5.00pm: Prof B.R. Heywood
"Bioinspired Crystal Growth - new routes to the controlled fabrication of inorganic materials."

The 5th Kelly Lecture

Introduction by Prof Tony Kelly

5.30-6.30pm: Prof Akihisa Inoue

"**Bulk Nonequilibrium Alloys by Stabilization of Supercooled Liquid: Fabrication and Functional Properties** "

We have produced a number of bulk glassy metals by casting processes in special alloy systems with the following component rules: (1) multi-component, (2) atomic size mismatches greater than 12 %, and (3) negative heats of mixing. Alloys obeying the three rules have a new liquid structure with highly dense packing, new local atomic configurations and long-range homogeneity. The new configuration is the origin for the high glass-forming ability (GFA). Although the high GFA is obtained in a solute content range of 25-45 at%, partial deviation from the three rules causes the formation of nanocrystal(C)- and nanoquasicrystal(Q)-dispersed bulk glassy alloys in the same solute content range. When the alloys obeying the three rules are selected, the stabilization effect of the supercooled liquid can be utilized even in a lower solute content range.

We have fabricated various nonequilibrium phases: amorphous, nanoC + amorphous and nanocompound + crystalline phases in a range of 7-25 at%, nanoC- and nanoQ-dispersed crystalline phases in a range of 5-7 at% and novel solid solutions with ordered atomic configurations in a range less than 5 at%. The nonequilibrium alloys exhibit useful characteristics in mechanical, chemical, magnetic and forming process fields and are being used as structural and functional materials.