to acoustic wave resonances observed in the acoustic wave spectra, as had been suggested by Boronin and co-workers (7).

Results were compared with and without acoustic wave excitation over a wide range of crystal temperatures and CO partial pressures, at fixed O_2 partial pressure (6). From the results, samples of which are shown in Figures 2 and 3, the following observations were made. There was no acoustic excitation at low CO pressures (high O_2:CO ratios), but as the CO pressure was raised the rate of CO_2 production was found to be shifted towards a *lower* O_2:CO ratio with the acoustic wave excitation on. Similarly the temperature dependence of the reaction rate at constant O_2:CO ratio showed that a given reaction rate was reached at a *lower* temperature with the acoustic wave switched on. From Arrhenius plots, however, it was shown that the overall activation energy for the process was unaffected by acoustic wave excitation.

In further exploratory experiments we found, first, that acoustic wave excitation had no detectable influence on the clean surface Pt{110} (1 × 2) LEED pattern, although microscopic examination of samples after extensive excitation did reveal significant morphological changes. Secondly, using Reflection Absorption Infrared Spectroscopy we could detect no change in the CO absorption band from chemisorbed CO on the Pt{110} surface due to acoustic excitation; in particular, no site switching was induced.

More work, both theoretical and experimental, is required to understand the physical mechanism underlying the process. In order to examine the mesoscopic-scale distribution of adsorbate on the surface, and its possible alteration by acoustic waves, we are currently undertaking experiments with Rotermund in Berlin using a Photoelectron Emission Microscope: the coupling of low frequency, long wavelength vibrational modes into the reactive behaviour of adsorbates must presumably involve mesoscopic-scale substructures on the surface, and we hope to find direct evidence for this. In the meantime, Inoue and his group at Nagaoka in Japan have reported some very large catalytic enhancement factors in catalytic processes at relatively high pressures (8) and, whatever the mechanism, the technological potential in the use of acoustic waves across catalyst beds deserves attention.

References

1 K. S. Suslick, *Science*, 1990, **247**, 1439

2 Y. Inoue and Y. Matsukawa, *Chem. Phys. Lett.*, 1992, **198**, 246

3 M. Gruyters, T. Mitrelias and D. A. King, *Appl. Phys. A*, 1995, **61**, 243

4 T. Mitrelias, V. P. Ostanin, M. Gruyters and D. A. King, *Appl. Surf. Sci.*, 1996, **101**, 105

5 S. Kelling, T. Mitrelias, Y. Matsumoto, V. P. Ostanin and D. A. King, *J.C.S. Faraday Discuss.*, in press

6 S. Kelling, T. Mitrelias, Y. Matsumoto, V. P. Ostanin and D. A. King, *J. Chem. Phys.*, 1997, **107**, 5609

7 V. N. Brezhnev, A. I. Boronin, V. P. Ostanin, V. S. Tupikov and A. N. Belyaev, *Chem. Phys. Lett.*, 1992, **191**, 379

8 Y. Inoue, Y. Watanabe and T. Noguchi, *J. Phys. Chem.*, 1995, **99**, 9898

Cold Platinum Cathode

Field emission displays which use cold cathodes to generate the electron beam are highly suitable for future flat panel displays as they provide complete colour capability, have a large viewing angle and are cost efficient. But until now, cold cathodes have produced an electron emission efficiency of less that one per cent.

Now, however, a team from Pioneer Electronic Corporation, Japan, has developed a cold cathode with a greatly increased electron emission efficiency using a Pt/SiO_x/Si/Al structure on a thermally oxidised silicon substrate (N. Negishi, T. Chuman, S. Iwasaki, T. Yoshikawa, H. Ito and K. Ogasawara, *Jpn. J. Appl. Phys., Part 2*, 1997, **36**, (7B), L939–L941).

The silica and silicon films, 400 nm and 5 μm thick, respectively, and platinum, 10 nm thick, were deposited onto a 300 nm thick film of aluminium, with the platinum and aluminum films used as the cathode electrodes. The electron emission was evaluated using a glass plate coated with a transparent electrode of indium-tin oxide and phosphors as anode and screen, respectively.

At room temperature and with an applied voltage of 110 V and accelerating voltage of 5 kV, an electron emission efficiency of 28 per cent was achieved together with brightness for green emission of 80 kcd m^{-2}, using ZnS:Cu,Al. The high emission efficiency may be closely linked to the occurrence of negative resistance.