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Platinum Nanochannel Replica Membranes

Nanoscale materials are widely used in electronic and optical devices, and for filtration and biological applications; so there is clearly a need for suitable production and patterning techniques, and some have been discussed here before, *Platinum Metals Rev.*, 1993, **37**, (2), 101.

Researchers at the Naval Research Laboratory, Washington D.C., U.S.A., now report the preparation of thin platinum membranes using nanochannel glass replica membrane technology (D. H. Pearson and R. J. Tonucci, *Science*, 1995, **270**, (5233), 68–70).

The thin membranes produced, which can be fabricated from platinum, gold, tungsten and molybdenum, contain uniform, nanometrescale, patterned voids. The metal membranes are formed on nanochannel glass (NCG) wafer substrates. The NCG material is fabricated by a draw process similar to the preparation of optical fibres and the fibres are packed together in a hexagonal close-packed arrangement. The fibres are then repacked and redrawn to achieve the desired packing density and element size, made into wafers, polished and etched. Other packing schemes enable more complex void patterns to be achieved.

The usual deposition techniques are employed to deposit an easily dissolved buffer layer of aluminium onto the NCG, followed by a 75 nm thick layer of platinum by magnetron sputtering. The buffer layer is dissolved in sodium hydroxide and the platinum replica membrane floated off. Thin platinum membranes having a uniform, hexagonal pattern of voids as small as 40 nm in diameter, and possibly less, have been formed. The membranes, displaying good mechanical properties, can be used as masks in pattern deposition onto substrates. This method is said to be an improvement on the usual lithographic techniques and involves fewer steps.

Increased Catalytic Activity

Clearly, it would be advantageous if the catalytic activity and/or the selectivity of a heterogeneous catalyst could be varied by a signal given to the catalyst.

Recent studies by scientists at the Nagaoka University of Technology, Japan, have lead them to conclude that remarkable enhancements in the catalytic activity of a thin film palladium catalyst supported on ferroelectric lead strontium zirconium titanate and lithium niobate substrates can result from resonance oscillation of the material (Y. Inoue and Y. Ohkawara, *J. Chem. Soc., Chem.Commun.*, 1995, (20), 2101–2102).

Using the resonance oscillations generated by low-frequency voltages of the ferroelectric substrates, remarkable 250 to 300 fold increases in activity of the catalyst surfaces were found during ethanol oxidation. I.E.C.