

Preface[☆]

The recent discoveries, in a number of different laboratories, that gold can be prepared in catalytically active forms, and that these catalysts have special and attractive properties with commercial potential [1–5], were highlighted during a 3-day conference entitled ‘Catalytic Gold 2001’, held in Cape Town from 2 to 5 April [6]. This meeting brought together the world’s leading researchers in this field, and industrialists were able to assess the usefulness of the results obtained till now. Eighty five delegates from 15 countries attended the conference, which was sponsored by both mining and industrial companies such as the World Gold Council, Anglogold, Mintek, and Engelhard-CLAL. There were representatives from six commercial application companies, and others were represented indirectly. There was the feeling of excitement often associated with the discovery of new science, particularly when there is also a promise of new applications that will benefit society.

The opening address was by the South African Minister of Arts, Culture, Science and Technology, Dr. S. Ngubane. He said it was highly appropriate that a conference on gold should take place in Southern Africa, the source to date of at least 47,000 t, or almost exactly one-third of all the world’s gold; and it has been estimated that another 36,000 t of gold remain, although some of it is not recoverable at the present gold prices. Gold has been mined and used by the inhabitants of Southern Africa for at least 2000 years: a beautiful gold rhinoceros is one of the many interesting artefacts recovered from the ancient city of Mapungubwe in the far north of South Africa.

There is enough gold in the world to support many future industrial applications and this is, therefore, good news for South Africa because gold and the gold mining industry contribute significantly to its economy. Consequently, the South African government is pleased to note that the interest in using gold as a catalyst is growing.

In my introduction as chairman of the first session, I commented on how my work as a Technical Editor for *Gold Bulletin* has given me a positive feeling about the uses of gold, which are not really very many—not as widespread as that for the platinum group metals. One of the reasons for this is a comparative lack of investigation: we are taught, even in our earliest school chemistry lessons, about the incorruptibility and absence of corrosivity of gold. Fortunately, there were some in the Cape Town audience who had disregarded this generalisation and found that catalysis by gold has special characteristics both when used homogeneously in solution and heterogeneously in the gas or liquid phase. I had learnt about the new gold chemistry and new gold catalysis over the past 5 years or so, largely from my editor’s chair, and one of the exciting prospects for this conference was the opportunity of meeting many of these pioneer practitioners!

The conference was divided into four sessions: ‘Catalytic Gold in the Synthesis of Fine Chemicals’, ‘Physical Characterisation of Small Gold Particles’, ‘Catalytic Gold in Industrial Processes’ and ‘Catalytic Gold in Environmental Control’. There were five keynote lectures, and an evening workshop where lively discussions took place. The keynote talks were entitled ‘Gold—A Relatively New Catalyst’ by Professor Geoffrey C. Bond of Rickmansworth, UK [7]; ‘Gold Chemistry and Gold Catalysts’ by Professor Hubert Schmidbaur, Technical University of Munich, Germany; ‘Gold Catalysts in Chemi-

[☆] Much of the material included in this Preface was published as parts of a *Gold Bulletin* article entitled ‘Highlights of the International Conference on Catalytic Gold, Cape Town, South Africa, 2–5 April 2001’ (see [6] above) and is reprinted here with permission from World Gold Council.

cal Processing' by Professor Graham Hutchings, Cardiff University, UK; 'Supported Gold Catalysts for CO Oxidation and Other Environmentally Important Reactions' by Dr. Masatake Haruta, Director, Research Institute for Green Technology, Tsukuba, Japan; and 'The Catalyst Design Challenges Posed by New Fuel-Cell Technologies, by Dr. Stan Golunski, Johnson Matthey Technology Centre, Reading, UK. Most of the presentations made at the conference are represented by papers published in this special issue.

Professor Hutchings was the facilitator for the open discussion at the evening workshop entitled 'Why do gold catalysts work at all?'. There was a full attendance and a lively open discussion took place. Gold catalysis has some unusual features, some of which are unique, and the mechanisms of the various reactions, particularly of carbon monoxide oxidation, which has received more attention than most of the others, was the focus of the deliberations. The activity of a gold catalyst depends critically on its method of preparation and the conditions under which it is calcined and used. Various oxidation states of gold may be involved, and the interface between the small gold particles and the support seems important. The support plays a key role in supplying oxygen to the gold, thereby increasing its activity. A suggestion was made for producing reference gold catalysts which would be made available to workers in the field for comparison. Method of preparation, choice of support(s), gold particle size, and calcination and storage conditions would all need to be carefully defined.

This was the first major international conference on gold catalysis, and many of the delegates were meeting each other for the first time. The special nature of gold chemistry and gold catalysis came through clearly, and there is promise for applications in areas such as pollution control, chemical reactions, fuel cell systems, and sensors. Some of these applications may be new, and could be based on the low temperature activity of supported gold or the novelty of the organic transformations catalysed by soluble gold species. The basic chemistry of gold has received less attention than that of other precious metals [8], and new opportunities for catalysis will arise as the number of gold species available is extended.

In his concluding remarks, the present Guest Editor highlighted some of the above aspects. He also saw plenty of scope for further development of the very incomplete initial research which has taken place till now. In addition to studies aimed at elucidating various aspects of the reaction mechanisms, new work on gold alloy catalysts and new supports should be encouraged. The growing number of patents being filed by companies demonstrates industrial interest in exploiting the emerging technologies. There would be a further opportunity for scientists interested in hearing about more new developments, at the forthcoming Symposium on Gold and Silver Catalysis taking place in Limerick, Ireland, in September 2001 [9], as a part of the EuropaCatV meeting. In all, 42 were papers accepted for presentation at this Symposium; 19 of the oral presentations and 17 of the posters were principally or entirely on gold catalysis. The papers covered all the areas discussed at the present conference in addition to some new topics, including electrocatalysis by gold.

We may be at the beginning of a trend where some of the gold presently kept in bank vaults will be called upon to be used in industrial catalytic applications. A second conference in the same series was, therefore, suggested and the organising committee was given charge of fixing a venue and programme for this, probably in North America in 2003. In a post-conference review, it was recommended that more lectures of the type presented by Stan Golunski on fuel cell requirements would assist industrialists in finding the best opportunities for the application of gold catalysts.

The editor thanks all the contributors to this special issue of *Catalysis Today* and all the referees for their careful work in reviewing the first and subsequent manuscripts. I am also grateful to Professor B.E. Nieuwenhuys for his encouragement. I hope that readers will find the papers informative and that these will stimulate more research work in this new and exciting field.

Acknowledgements

The Guest Editor thanks the World Gold Council for providing funds to support his work on this special issue.

References

- [1] G.J. Hutchings, Gold Bull. 29 (1996) 123.
[2] M. Haruta, Catal. Today 36 (1997) 153.
[3] D.T. Thompson, Gold Bull. 31 (1998) 111;
D.T. Thompson, Gold Bull. 32 (1999) 12.
[4] G.C. Bond, D.T. Thompson, Catal. Rev. Sci. Eng. 41 (1999) 319.
[5] G.C. Bond, D.T. Thompson, Gold Bull. 33 (2000) 41.
[6] D.T. Thompson, Gold Bull. 34 (2001) 56.
[7] G.C. Bond, Gold Bull. 34 (2001) 117.
[8] D.T. Thompson, Chem. Brit. 37 (November 2001) 43.
[9] D.T. Thompson, Gold Bull. 34 (2001) 134.

David T. Thompson
Consultant to World Gold Council, 'Newlands'
The Village, Whitchurch Hill, Reading RG8 7PN, UK
Fax: +44-118-984-5717
E-mail address: dtthompson@aol.com
(D.T. Thompson)