

Comment

Reply to Comments on Heterogeneous catalysis since Berzelius:
some personal reflections

[by H. Heinemann, B.H. Davis and G.A. Mills]

M.W. Roberts

I am grateful for the comments of Heinz Heinemann, Burtron Davis and Alex Mills (HDM) on the above article. Although my research interests have had a fundamental flavour they have been stimulated by industrial problems. The role of sulphur in the Mond carbonyl process, methanol and ammonia synthesis and selective oxidation catalysis are some examples. Never the less the particular slant or emphasis I took in the above (invited) article, was very different from the approach that would be adopted by an industrialist where perhaps empirical observations and serendipity play a more significant role in their quest for new and commercially viable catalysts. But I did attempt to achieve a reasonable balance.

I will consider the points made by HDM in the order they appear in their comments (above).

- (1) Houdry's contribution is highlighted in the first paragraph (in italics) on page 15 of my article with further details mentioned on page 16. The significance of high-octane fuel in the performance of fighter aircraft is also mentioned on page 16. Some of the photographs used in my article were taken from the excellent book (reference 6 quoted on page 27 of my article) edited by Davis (one of the authors of the above comments) and Hettinger. This book is devoted to "the US Pioneers of Heterogeneous Catalysis during the 1920's and 1930's". There was, however, no photograph included in the article by Oblad in the Davis–Hettinger book describing Houdry's contribution to catalysis. This may partially explain my not including Houdry's photograph but there was also the limitation of space and indeed I possibly did less than justice (for example) to the United Kingdom's contribution to heterogeneous catalysis.
- (2) Haensel was also highlighted in the introductory paragraph on page 15 of my article with further comments made later in this chapter. There was also no photograph of Haensel included in the book by Burtron Davis and Hettinger and so in retrospect my omission should hopefully not cause too much concern.

- (3) As for C.L. Thomas' contribution and the comments of HDM, I can do no better than quote from the Davis–Hettinger book page 238 where an article by Voge (of the Shell Development Company) highlighted Thomas' work:

"Most significant was the work of C.L. Thomas. At UOP he had done early work on the cracking of the pure hydrocarbons. He had noted the hydrogen transfer reaction and other characteristic reactions. His paper (Ind. Eng. Chem. 41 (1949) 2564) was published simultaneously with that of Voge et al."

Hansford (on page 252 of the Burtron Davis–Hettinger book) also discusses the contribution of C.L. Thomas to the carbenium ion theory and draws attention to the work of Voge et al. concluding with the view that:

"it seems unlikely that a better theory as applied to catalytic cracking will ever replace it."

Neither Voge nor Hansford refer in their articles to the work of Milliken, Alex Mills and Oblad, but I am most grateful for the information supplied by Heinemann, Davis and Mills.

- (4) Various modifications of ZSM-5 are mentioned on 5 separate occasions in the table on page 67 of my article as significant to a range of catalytic reactions; see also my reference to Weisz and Chang on page 53 regarding the use of HZSM-5 for the conversion of methane to gasoline. Metallocene catalysis is mentioned on pages 65 and 69.
- (5) The reference to the table is given on page 65 of my article and is taken from the book by J.M. Thomas and W.J. Thomas (reference 6, page 70).

Finally, I am grateful for the comment HDM made in their fourth paragraph, correcting my statement (page 15 of my article) regarding the development of high-octane fuel.