John Meurig Thomas (1932–2020)

Sir John Meurig Thomas, who was one of the leading materials and catalytic scientists of his generation, sadly died in November 2020, aged 87.

Thomas was born in Wales, the son of a coal miner, and his early life was spent in the Gwendraeth Valley in South Wales; throughout his life he remained passionately committed to his native land, its language and literature. He was both an undergraduate and postgraduate student at Swansea University and after a brief postdoctoral period at the Atomic Weapons Establishment, Aldermaston, he was appointed a Lecturer at Bangor University and subsequently Professor at Aberystwyth University. In 1978 he moved to the University of Cambridge as Professor of Physical Chemistry and subsequently to London, where he was Director of the Royal Institution from 1986–1991 — an ideal role for him as it allowed him to combine his creativity as a scientist with his deep interest in the history of science and his skills as a lecturer and communicator of science. In the early 1990s he took up a senior appointment in the University of Wales before returning to Cambridge as Master of Peterhouse College. More details of his remarkable career can be found in several eloquent obituaries and tributes, for example ref. [1]. Our focus here will be on his wide-ranging and highly influential scientific contributions.

Thomas was a pioneer in solid-state and materials chemistry and throughout his career developed and applied new concepts and techniques. An excellent early example is provided by his article from 1974 on 'Topography and topology in solid state chemistry'[2] — a typically alliterative title — which explores the role of topological concepts in organic and inorganic solids. The review is a fascinating account of the early uses of techniques and concepts that have become standard and widespread in materials science.

His greatest scientific contributions were, however, in the field of heterogeneous catalysis; his impact in the field was again characterized by both conceptual and technical innovation. An excellent and landmark example is provided by his work in the early 1990s, exploiting recent developments at the Daresbury Synchrotron Radiation Source, where Greaves, Dent and Derbyshire had combined rapid X-ray diffraction and X-ray spectroscopy instrumentation, allowing time-resolved measurements of both long-range and local structure on the same sample under identical reaction conditions. Working with the Daresbury team, Thomas and collaborators were able to track the complex structural changes occurring when aurichalcite is calcined to form the Cu/ZnO catalysts used in methanol synthesis[3].

Credit: Kevin Quinlan / University of Delaware

From the early 1980s, Thomas became increasingly fascinated by nanoporous catalytic materials — zeolites, aluminophosphates and subsequently mesoporous silicas. Technical innovation is again apparent, as in his work[4] applying magic-angle spinning nuclear magnetic resonance to follow structural changes, in this case during the ultrastabilization of zeolite Y — the petrochemical-cracking catalyst. He also, much earlier than most experimentalists, appreciated the growing power of computer modelling in solid-state science and had indeed collaborated with Parker and Catlow at University College London to use modelling tools to rationalize experimental data on the structural properties of pyroxenoid silicates[5]. Much of his work on microporous catalysts in the 1990s combined experiment with modelling, an excellent illustration being work on computational template design[6]. Borrowing concepts from drug design, Lewis and Willock developed software that computationally 'grew' synthesis templates inside a target microporous host. The procedure worked: the di-substituted cyclohexane derivative predicted as a suitable template for the levyne-structured ALPO was then successfully synthesized — a genuine example of de novo computational design. In the mid-1990s his interests broadened to include mesoporous materials, enabling him to study one of the most significant conceptual developments in catalysis over the last decades — single-site catalysis. Thomas was an early explorer in developing this new field. His work focussed on using mesoporous silica MCM-41 as a support or tether for new single-site catalysts. MCM-41 provided ordered mesopores that could be tuned in diameter, thereby adding a degree of confinement for the single-site catalysts. Working with Maschmeyer, Sankar and Rey, a landmark publication appeared in 1995[7] in which metallocenes were grafted onto the walls of MCM-41 and were shown to be a highly effective epoxidation catalyst for cyclohexene and pinene using tetrabutylperoxyhydroxide as oxidant. This catalyst had the advantage over Ti-silicalite (TS-1) as the pores of Ti-MCM-41 were significantly larger (3 nm) and this permitted access to much larger substrates.

Thomas published prolifically, with over 1,100 papers, reviews and books, during his exceptionally productive career. His publications in Nature journals provide a fascinating tour of topics and people in science over the last six decades. In this short article it has not been possible to do justice to Thomas's achievements, but we hope that it has given a glimpse of his science, which will have an enduring impact on our understanding of materials and catalysis. ❐

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