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The importance of nanoarchitecture in advanced high performance heterogeneous catalysts

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Our current lifestyle in the developed countries would not be possible if we did not have access to high performance heterogeneous catalysts. These materials lie at the heart of our industrial processes for oil, petrochemicals, polymers, pharmaceuticals, energy conversion and environmental protection and ever-increasing demands are being placed on catalysts for the future. Very high performance heterogeneous catalysts will almost always demand that considerable attention is paid to the detailed nanoarchitecture of the solids. This point will be illustrated by several examples, including thermostable gold catalysts for environmental protection, based on the use of nanoflower-structured support decorated with nano-sized metal particles. These materials have greatly improved thermal stabilities against conventional materials and this could see new applications in several areas, especially environmental protection. Catalysts for the decomposition of methane in low carbon footprint conversion of natural gas to electricity can also be improved by incorporation of suitable nanomaterials such as medium and wide-pore zeolites. A further example is provided by photocatalysts for biomass conversion to syngas and hydrogen, where at the nano level the inhibition of charge pair recombination is required for high reaction rates. The devices and procedures available for manipulation of nanoarchitecture include microwave radiation treatment and the use of non-thermal plasmas. The extent to which these approaches can be used in improving solid catalysts will also be discussed.

Recent Publications

1. W M Dlamini, N J Coville, M S Scurrell (2016) Microwave treatment: A facile method for the modification of potassium-promoted iron/silica Fischer-Tropsch catalysts. *RSV Advances*; 6: 22222-22231.

2. D H Barrett, P J Franklyn, C B Rodella, B Diaz, D G Billing, M S Scurrell (2016) Achieving nanogold stability through rational design, *Chem Sci;* 7: 6815-6822.

Biography

Mike S Scurrell is Research Professor in the Department of Civil and Chemical Engineering at the University of South Africa and Emeritus Professor of Chemistry at the University of the Witwatersrand, Johannesburg, South Africa. His research interests concern heterogeneous catalysis and nanomaterials, especially for energy conversion and environmental processes and he is also involved in novel nanomaterials synthesis involving microwave radiation and non-thermal plasma treatment.

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