Project report

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Functional materials- A block Proposal: XAFS studies on nanopowders, anion deficient perovskites and microporous catalysts

Part 2
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Air pollution caused by nitrogen oxides (NOx) emissions from lean burn engines in cars and stationary sources is a problem that in principle could be solved using the ideal catalyst. Those catalysts used today include noble metals or transitions metals on a carrier. There has been a huge effort made in the development of stable and economically profitable materials, and great attention has been aimed towards zeolites ion-exchanged with copper[1-3]. Large interest has been attracted to studies on the zeolite CuZSM.-5 who has shown greater activity in the selective reduction of NOx than traditional catalysts. The backside is the CuZSM-5 is only active over a limited temperature range, and there is also a drastic decrease in activity if water is present in the stream. Thus there has been a number of studies on copper based materials for the reduction of NOx. Studies on other group 1B elements (Ag, Au) have on the other hand been few [4]. We have collected EXAFS data on a number of copper or silver ion-exchanged zeolites made from a new and unconventional method, in addition to zeotypic materials incorporated with the same materials. Results from EXAFS show copper is present in an environment different from that already reported (Fig. 1). Analyses of the silver zeotypes show that silver is present as Ag^0 in as-synthesised materials but that they are oxidised to Ag^+ upon calcination (Fig. 2). We now have information about the local environment of copper and silver in these materials which can give us information about the mechanism for the reduction of NOx. This is still a work in progress, as we need to perform in-situ studies to monitor the metal environment in the presence of NOx.

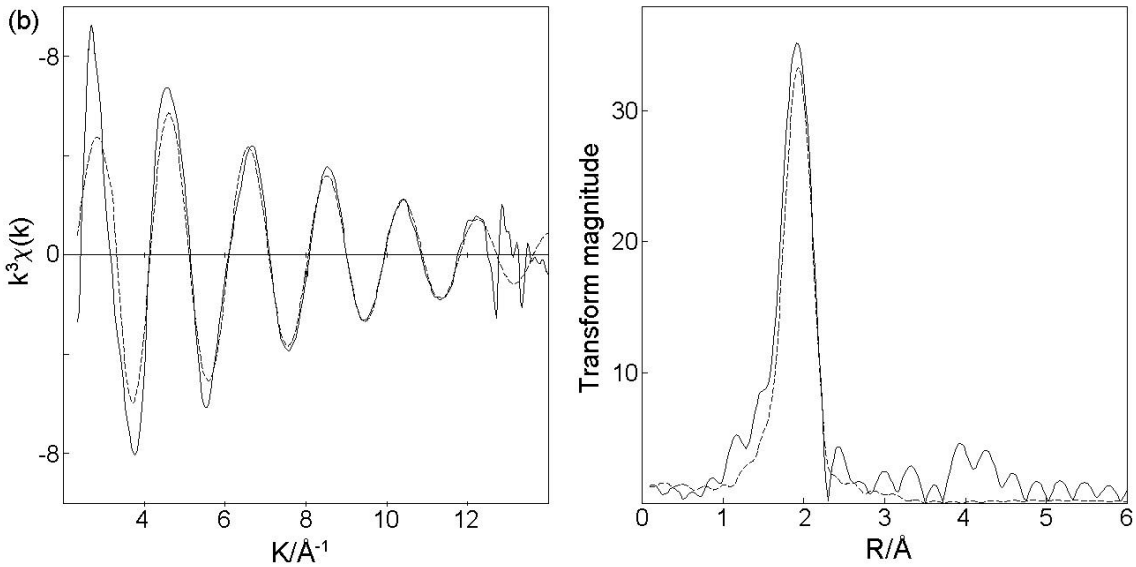

Fig.1 Experimental (—) and calculated (---) Fourier filtered (1-25) EXAFS and its Fourier Transform for CuZSM-5; (b) calcined (k^3-weighted).

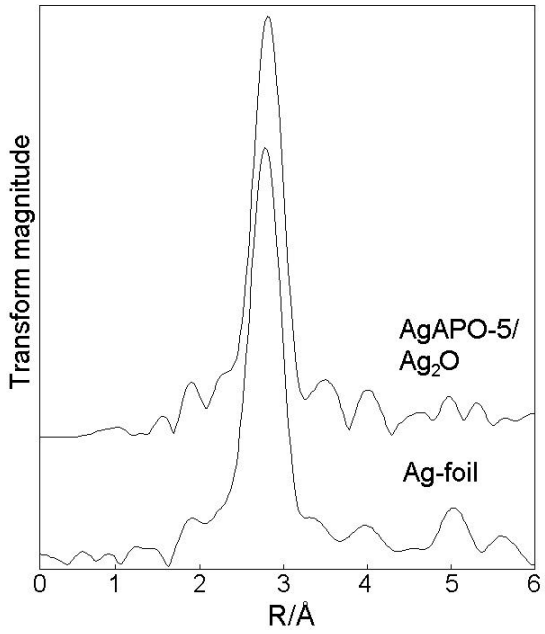

Fig.3 Experimental Fourier filtered (1-25) EXAFS and its Fourier Transform for as synthesised AgAPO-5 made from silver(I)oxide compared to Ag-foil.

References

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2. M. Iwamoto, Chem. Lett., 1991, 1959.
3. D. B. Akolekar, S.K. Bhargava, J. Mol. Catal., A: Chem., 2000, 206.
4. A. Moen and D.G. Nicholson, Unpublished results.