Project report

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A programme of XAFS studies on a Variety of Functional and Advanced Materials

Part 1
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Numerous studies show that a variety of copper materials are active towards the reduction and decomposition of nitrogen oxides (NOx).[1-3] In contrast to the copper- containing zeolites relatively few studies have been reported on another class of zeotypes namely copper-containing microporous aluminium phosphates (AlPO's).[3-6] Metal cations can be introduced either by impregnation or during the hydrothermal synthesis itself. Including a source of silicon in the reaction mixture yields SAPO's.[7] The resulting framework now has a net charge that makes possible ion exchange and the creation of catalytically active sites. Introducing metals into SAPOs either directly during synthesis or through ion-exchange gives MeSAPOs.

We have collected EXAFS data on CuAPO-5 prepared by varying conditions to establish the dependence on copper source, Cu:Al ratio and Al:P ratio. Data has also been collected on CuSAPO-5 prepared by adding copper to the synthesis mixture, and by conventional and hydrothermal ion exchange. No results has previously been reported for CuSAPO-5 containing Cu(II). For comparison XAS data was also collected for mesoporous CuSAPO and CuAPO prepared by ion-exchange and by adding copper to the synthesis mixture. From these results we can compare the environment about copper in microporous and mesoporous materials (Fig.1).

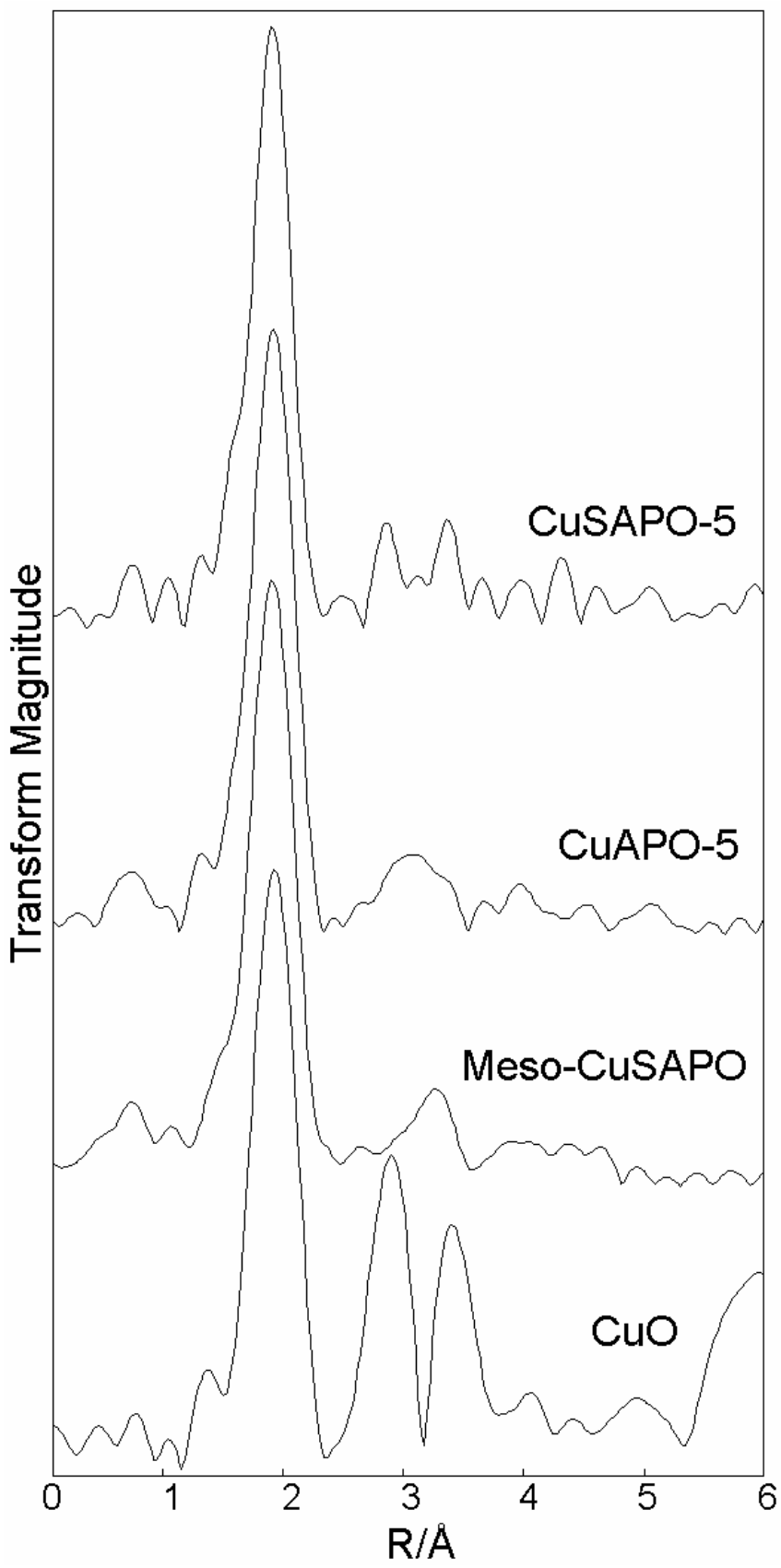

Figure 1 Experimental Fourier Transform for CuO, mesoporous CuSAPO, CuAPO-5 and CuSAPO-5.

References

1. G. Gopalakrishnan, P. R. Stafford, J. E. Davidson, W. C. Hecker and C. H. Bartholomew, Appl. Catal. B: Env., 1993, 2, 165-182.
2. M. Iwamoto, H. Yahiro, Y. Mine, S. Kagawa, S. Chem. Lett., 1989, 213.
3. W. Grünert, N. W. Hayes, R. W. Joyner, E. S. Shpiro, M. R. H. Siddiqui and G. N. Baeva, J. Phys. Chem, 1994, 98, 10832-10846.,
4. David. G. Nicholson and Merete H. Nilsen, J. Mater. Chem., 2000, 10, 1965,
5. D. Burton, J. S. J. Hargreaves, D. G. Nicholson, M. H. Nilsen and M. Stockenhuber, J. Mater. Chem., 2000, 10, 1965.
6. D. Panayotov, L. Dimitrov, M. Khristova, L. Petrov and D. Mehandjiev, Appl. Catal. B: Env., 1995, 6, 61-78.
7. B. M. Lok, C. A. Messina, R. L. Patton, R. T. Patton, R. T. Gajek, T. R. Cannan and E. M. Flanigen, J. Am. Chem. Soc., 1984, 106, 6092.