Project report

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XAS studies on the silver and copper environment in mesoporous aluminium phosphates

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Since the establishment of CuZSM-5 materials high activity for the decomposition of NOx in the presence of hydrocarbons (SCR-HC) there has been a great interest in copper materials and their catalytic properties.[1] The mechanism for selective nitric oxide reduction on conventionally ion-exchanged zeolites is believed to occur via the reduced Cu^I form. Several methods have been reported for preparation of CuZSM-5 including the conventional ion exchange, and a procedure that involves stirring and addition of NH_3 while monitoring the pH.[2] Hydrothermal ion exchange has also been reported by Lassoued et al.[3] It is of special interest to compare our ion-exchanged copper zeolite made by a nonconventional procedure with the conventional CuZSM-5, and also with other copper incorporated zeotypes. Presence of Cu^I is easily detectable using XAS due to a strong pre-edge feature in addition to information obtained about the local structures about the target atoms.

We have collected XAS data on CuAPO-5 prepared with varying copper content and CuZSM-5 prepared conventionally and by hydrothermal. Samples were pretreated with oxidising or reducing agents in an in-situ cell previous to data collection to establish the presence of a Cu^{2+}/Cu^+ red-ox pair. The XANES data gives direct information about the oxidation state of copper in the material (Fig 1).

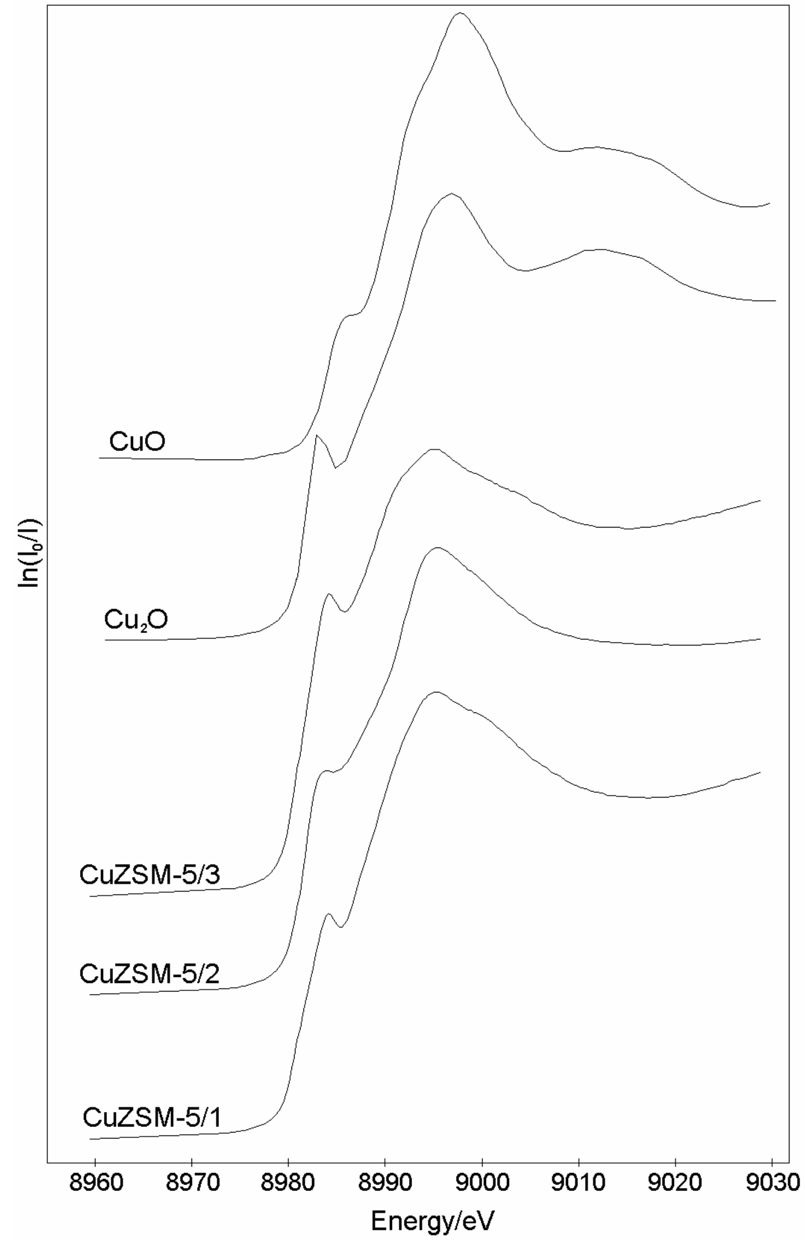

Figure 1 Normalised Cu K-edge XANES of CuZSM-5 made by hydrothermal ion-exchange; (1) calcined and activated in oxygen (6%) before treatment with propene (0.36%); (2) sample treated with NO (0.6%); (3) sample treated with propene (0.36%) again compared to copper(II) oxide and copper(I) oxide.

References

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