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Sulfated Zirconia Thin Films

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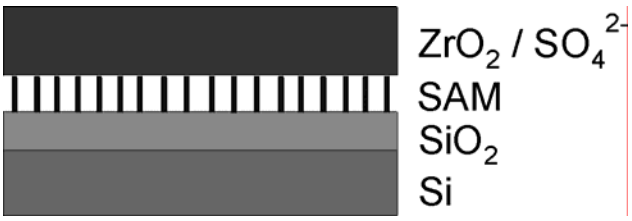
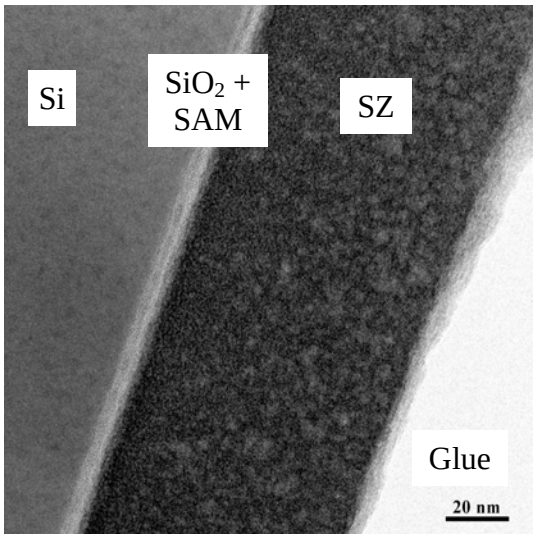
Sulfated zirconia (SZ) has been found to be catalytically active for the isomerization of *n*-butane at room temperature [1]. This discovery has led to numerous investigations into the catalyst; however, no consistent theories have been devised to satisfactorily explain its structure, acidity and reactivity [2]. In order to improve surface characterization, a model system consisting of a nanocrystalline SZ thin film supported on a silicon wafer has previously been developed [3, 4]. The films are prepared using an aqueous route via a self-assembled monolayer (SAM), in which the film thickness is accurately controlled by deposition time.





SZ thin films have been synthesized as described in [3, 4]. Successful formation of a SZ thin film has been verified by using XPS, SEM and HRTEM techniques. The process of thermal treatment of the films in order to remove the non-conducting SAM and to crystallize the sulfated zirconia has been investigated using SEM and XPS. The thermal conductivity of the thin films has been utilised in ongoing TDS studies of the films, investigating acidic sites on the films using probe molecules.

A powder catalyst has been prepared with an analogous synthesis method, which allows estimation of the activity of the thin films. Direct comparisons of characterisation data with other powder SZ catalysts can also be drawn from this sample.

To validate the use of the prepared thin films as a model for the SZ zirconia powder catalyst, a novel reactor has been designed specifically to test the activity of the thin films and is under construction.

References

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