



Universitat Rovira i Virgili

Departament de Química Física i Inorgànica

Improvement of the properties of zeolites for
application in the nitrogen and oxygen
separation process and in acid catalysis

Memòria de tesi doctoral

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La Dra. Pilar Salagre Carnero i la Dra. Yolanda Cesteros Fernández, professors titulars del Departament de Química Física i Inorgànica de la Universitat Rovira i Virgili.

CERTIFICA:

Que la memòria de tesi doctoral “Improvement of the properties of zeolites for application in the nitrogen and oxygen separation process and in acid catalysis”, que presenta Isabel Salla Cabau per a optar al grau de Doctor per la Universitat Rovira i Virgili, ha estat realitzada sota la nostra direcció en el Departament de Química Física i Inorgànica de la Universitat Rovira i Virgili.

Tarragona, Juliol 2005.

Dra. Pilar Salagre Carnero

Dra. Yolanda Cesteros Fernández

Després de tot el que ha suposat la realització d'aquesta tesi doctoral, m'agradaria expressar el meu agraïment a totes les persones que m'han ajudat tant durant aquest període, però especialment:

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The present thesis studies several processes that take place on such aluminosilicate materials as mordenite, zeolite A, and zeolites X and Y. The thesis is presented in six chapters. Chapter one is a general introduction to zeolites: their composition, structure, properties and uses, and, in particular, the state of the art of the processes studied here, which are the separation of N₂ and O₂ from air and the acid isomerisation of styrene oxide to phenylacetaldehyde. The objective of the thesis is presented in accordance with the state of the art and the present and future trends in zeolites.

The second chapter, the experimental part, makes a detailed description of the zeolites used in this thesis, and the characterisation techniques, apparatus and conditions used. It also briefly describes the adsorption and catalytic procedures.

The third, fourth and fifth chapters present the results of the various studies, most of which involve zeolites. All these studies have been published, are in press or have been submitted to journals related to the field and, therefore, these parts will be presented as articles.

Chapter three deals with the nitrogen and oxygen adsorption. Mordenites and A zeolites have been used for this purpose.

Once the mordenites used in the separation experiments had been characterised, we believed that these modified mordenites could be used in acid-catalysed reaction. Chapter four presents the results of several mordenites in the styrene oxide isomerisation in liquid phase using conventional and microwave heating.

Chapter five discusses the FTIR spectroscopy characterization, made by adsorbing different probe molecules on zeolites and studying the interactions adsorbate-adsorbent. These studies allow us to better understand our systems.

Finally, the last chapter draws the general conclusions of the present thesis.