PREFACE

Industrial applications of heterogeneous catalysis are proliferating at an increasing rate. Although huge amounts are spent each year on the development of new catalysts and new catalytic processes, the phenomena occurring on the surface is not yet definitely understood. Despite all the developments there exists a huge gap between our knowledge in catalysts and their various physico-chemical behaviour. In fact the selection and manufacture of catalysts for specific purposes are largely empirical and still remain more an art than a science.

Various attempts, through different approaches, have been made from time to time to find out a generalisation which would allow even a partial prediction of the course of catalysis. Adsorption techniques, kinetic studies, microscopic and x-ray investigation, electric and magnetic measurements all have shed considerable light on the solution of the problem but with very limited success.

Recently nuclear science developments have offered two new approaches to the study of heterogeneous catalysis; stable and radioactive isotopes for the elucidation of reaction mechanism and high intensity radiation for the possible intensification and change of catalytic properties.

The hopes that high energy radiation might increase the efficiency or selectivity of the industrial catalyst have not yet been fully realised for various troubles that crop up while working with the irradiated and pre-irradiated solids. Keeping all the limitations in mind most of the investigations made so far have been confined to relatively simple systems which may be far removed from the real industrial practices. Nevertheless the results and information obtained so far are very promising. By combining work on irradiated solid, which can be characterised by a variety of physical techniques (chemisorption, ESR, conductivity etc.), with a study of specific catalytic reaction on the same material, valuable information may bbe obtained about the reaction mechanism. Parallel experiments with chemically doped materials would show whether the inferences based on modern theories of radiation damage and catalytic behaviour are correct or not.

Arising out of this work it might be possible to forecast instances where radiation would promote or assist catalytic reactions.

The investigations embodied in this thesis relate to the physico-chemical studies on irradiated and nonirradiated vanadium pentoxide catalyst. To understand the mechanism of oxidation reaction, studies have been made on chemisorption, conductivity, surface area, pore structure etc. both before and after the bombardment of the catalyst with neutron. Attempts have been made to correlate these data with the catalytic activity.
