

Chapter 4

Temperature-Programmed Desorption (TPD)

Methods

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Abstract This chapter presents the fundamentals, the experimental setups and the applications of temperature-programmed desorption (TPD), method used to investigate the events that take place at the surface of solid material while its temperature is changed in a controlled manner. At the beginning, fundamental principles of adsorption and desorption phenomena, as well as the data concerning first experimental setups are given. Further, important information related to the construction of nowadays used equipment and the organization of common experiments are underlined. The significance of data directly obtained from temperature-programmed experiment—TPD profile, which are the area under it and the position of peak maximum, are highlighted. Particular attention is given to the results that can be derived from these data—characterization of active sites that can be found on the surface of solid material and determination of kinetic and thermodynamic parameters of desorption process. In this regard, the influence of important experimental parameters on derived values is explained. Besides, the distinctions between TPD experiments performed in ultra-high vacuum and in the flow systems (differences in experimental setups and in the derivation of kinetic and thermodynamic parameters) are explained. Also, the modification of temperature-programmed techniques, known as temperature-programmed oxidation and temperature-programmed reduction are shortly explained and compared with temperature-programmed desorption method. In the end, a brief comparison of the TPD and adsorption calorimetry, two most widely used techniques for the study of acid/base properties of catalysts, is given.

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