INFRARED SPECTROSCOPIC STUDIES OF CHEMICAL REACTIONS OF MOLECULES TRAPPED IN SOLID PARAHYDROGEN

T. MOMOSE, and T. SHIDA, *Division of Chemistry, Graduate School of Science, Kyoto University, Kyoto 606-01, JAPAN*.

Solid parahydrogen is a promising substance for high resolution matrix isolation spectroscopy. In addition, we have found another important feature of the parahydrogen matrix which enables us to study photofragments in the photolysis of parent guest molecules in the matrix. In other words, parahydrogen crystal is almost free from the so-called ”cage effect”. As is discussed repeatedly by a number of previous workers, matrix isolation spectroscopy using the conventional rare gas matrix often fails to trap in-situ photodissociation products on account of the cumbersome cage effect. However, owing to the extremely weak intermolecular interaction and the large intermolecular distance as well as the large zero point vibration, solid parahydrogen becomes a very soft medium for guest molecules. As a result, the photoproducts can be separated in the solid far enough to be stabilized. For example, the UV photolysis of methyl iodide and ethyl iodide trapped in solid parahydrogen yields very efficiently methyl and ethyl radicals, respectively. Because of the low temperature of the system these reactive radicals can be trapped stably in parahydrogen crystal after the thermalization. By virtue of these features, a variety of chemically interesting products of in-situ photolysis can be studied in solid parahydrogen. The stabilized reactive molecule can be subjected to detailed studies of the structure, the rovibrational motion, and the quantum tunneling chemical reaction with the hydrogen molecule in some cases by infrared spectroscopy. Some of our recent studies of in-situ photolysis will be presented.