

Photofragmentation of C 1s Excited Formic Acid

H. Ikeura-Sekiguchi,¹ A. P. Hitchcock,² T. Tyliczszak,² Y.F. Hu,³ and J. Maciel⁴

1. National Institute of Advanced Industrial Science & Technology, Tsukuba, Ibaraki, JAPAN

2. BIMR, McMaster University, Hamilton, ON, CANADA

3. CSRF, UWO, London, ON, CANADA

4. Chemistry, UFRJ, Rio de Janeiro, BRAZIL

Gas-adsorbate comparison studies are being used to investigate fundamental aspects of state-selective X-ray photochemical processes. Such studies may inform potential technological applications, ranging from preparation of novel materials, to X-ray lithography for ultra-large scale integration. Multi-ion coincidence time-of-flight studies of gaseous, partially deuterated formic acid (HCOOD) have been carried out in the C 1s region. Partial yields for all ions, and kinetic energy distributions of selected ions and ion pairs have been measured. The high kinetic energy signal has been used to investigate direct photofragmentation. Although the D atom is not bound to the C atom, there is an unusual feature at 292 eV which has enhanced yield of D⁺. At this energy, the COO⁺ yield is also clearly enhanced, which suggests neutral H production via ultrafast dissociation, in analogy to a similar signal at the (O1s⁻¹, 4a₁) state of water [1]. The results are compared to photon stimulated ion desorption from surface and condensed phases of DCOOD on Si(100) [2] and ab initio core excitation calculations. The study helps to differentiate direct and surface mediated bond breaking in the C 1s photofragmentation of surface adsorbed formic acid.

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[2] H. Ikeura Sekiguchi and T. Sekiguchi, K. Tanaka. Phys Rev. B 53 (1996) 12655.