

Reactions of ICH_2COOH on $\text{Cu}(100)$

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Surface intermediates, especially short-lived species, in practical heterogeneous processes are difficult to be detected. Therefore, the reaction mechanisms as well as the relation between reactivity and surface structure often remain unresolved. Preparation and isolation of catalytically important intermediates proposed in heterogeneous processes on single crystal surfaces can provide the reaction information about these surface processes.

ICH_2COOH possesses two functional groups of C-I and COOH and is expected to have a rich chemistry. Temperature-programmed reaction/desorption and x-ray photoelectron spectroscopy have been employed to investigate the reactions of ICH_2COOH on $\text{Cu}(100)$. Figure 1 shows the TPR/D spectra of 0.2 L ($1\text{L} = 1 \times 10^{-6} \text{ Torr}\cdot\text{s}$) ICH_2COOH adsorbed on $\text{Cu}(100)$. The ions of $m/z = 18, 28, 42, 44$, and 45 amu are presented to show the evolution of the reaction products of H_2O , CO , CO_2 , $\text{CH}_2=\text{C}=\text{O}$ (ketene), and CH_3COOH . The CO is desorbed at ~ 640 K; the others at ~ 550 K.

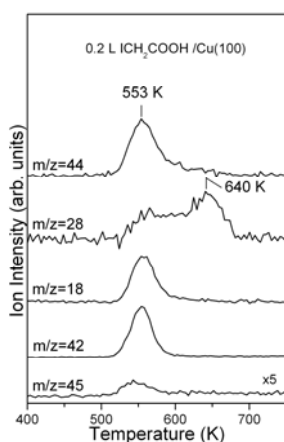


Figure 1. Temperature-programmed reaction/desorption spectra of 0.2 L ICH_2COOH on $\text{Cu}(100)$.

Figure 2 shows the x-ray photoemission spectra of C 1s, O 1s and I 4d of 0.46 L ICH_2COOH adsorbed on $\text{Cu}(100)$ at ~ 100 K, followed by briefly heating the surface to the temperatures indicated. Previous studies have shown the C-I bonds breaks below 200 K for alkyl iodide on copper surfaces. The similar I 4d spectra observed between 230-670 K indicate that the C-I bond of ICH_2COOH , dissociates on $\text{Cu}(100)$ at a temperature ≤ 230 K. The dissociation product is $-\text{CH}_2\text{COOH}$ which may be responsible for the 283.3 eV C 1s peak. The 284.8 and 287.5 eV peaks are assigned to $\text{CH}_3\text{COO(a)}$. The reaction of ICH_2COOH on $\text{Cu}(100)$ may leave surface carbon.

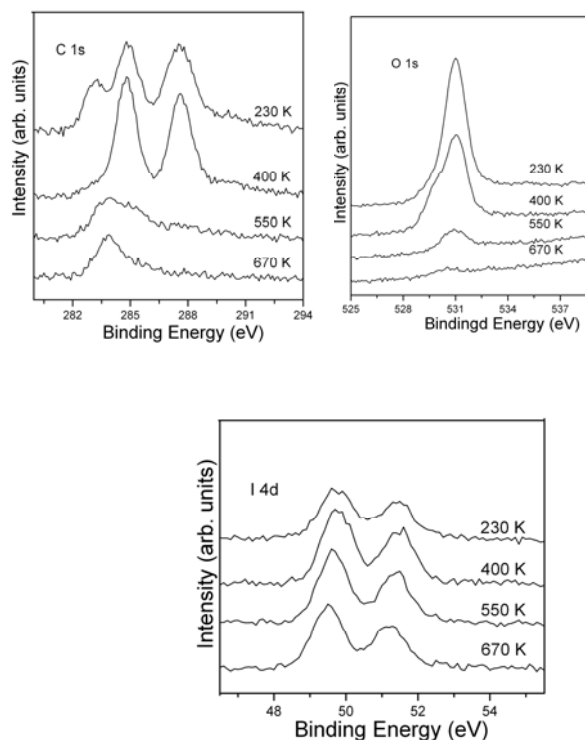


Figure 2. X-ray photoemission spectra of 0.46 L ICH_2COOH on $\text{Cu}(100)$