

## Dependence of H<sub>2</sub>CO and CH<sub>3</sub>OH formations on the temperature of ice in the successive hydrogenation of CO in H<sub>2</sub>O-CO ice

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In relation to evolution of CO molecules on ice dust in a molecular cloud, the formations of formaldehyde (H<sub>2</sub>CO) and methanol (CH<sub>3</sub>OH) by the successive addition of hydrogen atoms to CO molecules in H<sub>2</sub>O-CO mixed ice were measured at 10, 15, and 20 K. The maximum yield of CH<sub>3</sub>OH was obtained at 15 K followed by at 10 K. At 20 K, the reactions proceeded very slowly and the resulting yield of CH<sub>3</sub>OH was significantly smaller than those at 10 and 15 K probably due to a fall in the sticking probability of hydrogen at around 20 K. This temperature dependence indicates that the abundances of H<sub>2</sub>CO and CH<sub>3</sub>OH in a molecular cloud are strongly dependent on the temperature of dust as well as the flux of atomic hydrogen. Furthermore, the dependence of CO hydrogenation on ice thickness is measured in the range of about 30 monolayers. The diffusion of hydrogen atom in ice is discussed.