Reactivity of ZnO Surfaces toward Maleic Anhydride

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In this work, the adsorption and temperature induced-decomposition of maleic anhydride (MA, $C_4H_2O_3$) on the polar Zn−ZnO(0001) and O−ZnO(000$\bar{1}$) surfaces and on the nonpolar ZnO(10$\bar{1}$0) surface of zinc oxide were investigated using X-ray photoelectron spectroscopy (XPS) and near-edge X-ray absorption fine structure (NEXAFS). Despite the fact that molecules such as small hydrocarbons, alcohols, aldehydes, and carboxylic acids are generally reported to show higher reactivities on the Zn-terminated polar surface than on the O-terminated polar surface, we find that the temperature-induced decomposition of MA is essentially the same on both polar surfaces as well as on the mixed-terminated surface. In the case of the O-terminated surface, it was possible to correlate the defect density with the observed reactivity. Hence, regarding MA decomposition, the defect density seems to play a major role for the catalytic activity.