TEMPERATURE DEPENDENCE OF THE INFRARED SPECTROSCOPY OF OZONE IN SOLID OXYGEN[a]

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Irradiation with ultraviolet laser light (210 to 250 nm) generates ozone monomers and dimers in a solid oxygen matrix. For wavelengths longer than 240 nm, we observe a dominant doublet structure for each fundamental vibration of ozone, ν_1, ν_2, and ν_3, as observed in a lamp irradiation study[b]. In addition, we identify a doublet feature for the combination band, $\nu_1 + \nu_3$[c]. With higher excitation energy we observe even more features, especially in the ν_3 region and attribute them to ozone dimers in the oxygen solid. While the aforementioned doublet structures, for ν_3 at 1037.8 cm^{-1} and 1030.9 cm^{-1}, have been assigned to an ozone monomer and to a complex $O\cdots O_3$, respectively[a], our investigations indicate the latter feature is due to an ozone monomer isolated in an unstable lattice site. This conclusion results from detailed temperature studies of ozone-doped oxygen matrices. Furthermore, from the temperature dependence of the line position of the ozone monomer feature we observe the α–β phase transition of the solid oxygen host. The potential of this temperature shift as a novel temperature sensor for cryogenic matrices will be discussed.

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