REACTIVITY OF KETENE UNDER INTERSTELLAR CONDITIONS: FROM THE DILUTE PHASE TO THE CONDENSED PHASE

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The photodecomposition of ketene under interstellar conditions and how the resulting photofragments may recombine in the 3-300 K temperature range could play an important role in investigations related to astrochemistry and astrobiology. Using a combination of bulk ice and rare-gas matrix isolation studies coupled to FTIR spectroscopy, the present work aims to understand the VUV photochemistry of $\mathrm{CH_2CO}$ in solid phase to mimic the photochemistry of organic species trapped in the icy interstellar grains. We show that the photolysis of $\mathrm{CH_2CO}$ depends strongly on the environments where it is trapped. The VUV photolysis of $\mathrm{CH_2CO}$/Ne in dilute phase leads to kinetically stable and instable species such as CO, $\mathrm{C_2H_2}$, $\mathrm{CH_4}$, $\mathrm{C_2H_4}$, $\mathrm{C_2H_6}$, $\mathrm{H_2CO}$, $\mathrm{CH_3CHO}$, HCCO, $\mathrm{C_2O}$, $\mathrm{C_3O}$ and $\mathrm{C_4O}$. However, the same experiment carried out in condensed phase shows that the photolysis of $\mathrm{CH_2CO}$ ice produces mainly an organic residue which is directly observed at 10 K and remains stable in solid phase at 300 K. The IR spectroscopy analysis suggests that the resulting organic residue could be a polyketone formed at 10 K through the VUV photo-polymerization of ketene.