

Absolute intensities and photolytic behaviour of methyl mercaptan (HS-CH₃), ethyl mercaptan (HS-CH₂CH₃) and dimethyl sulfide (CH₃-S-CH₃) in solid Ar and in CO

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This work is an experimental study of HS-CH₂CH₃, HS-CH₃ and CH₃-S-CH₃ for astrophysical use. All belong to the family of astrochemical COMs (Complex Organic Molecules). Both mercaptans have been already detected in interstellar medium.

Although IR spectra of all of these molecules in noble gas ices is already known, no absolute intensities have been reported. Also, such molecules are thought to be born in interstellar ices consisting of large amounts of CO, yet no studies have been made in CO ices.

Compounds were suspended in carbon monoxide (CO) and in argon (Ar) matrixes at 6K. From interference fringes in IR spectra, matrix thicknesses were calculated and from these thicknesses, absolute intensities values for each vibration in both environments were estimated.

Deposited matrixes were exposed to UV radiation using an ArF excimer laser (194nm) and hydrogen lamp (121nm) in separate experiments for each combination of compound / medium. Photolytic products were similar and consisted of large amounts of CH₄, CS and (with exception of ethanethiol) CH₂=S as well as smaller amounts of other C_xS_y species. Additionally, small amounts of ethane, ethene and ethyne could be distinguished in the argon spectra.

As a last step of sample processing, thermal annealing at 25K was introduced for each compound/medium/light-source combination. The emission originating from sulphur recombination was observed between 12K and 20K.