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Past, Present, and Future

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Densities, infrared band strengths and optical constants of solid methanol.

R. Luna[a], G. Molpeceres[b], J. Ortigoso[b], M. A. Satorre[a], M. Domingo[a], and B. Maté[b]

[a] Centro De Tecnologías Físicas, Universitat Politècnica de València, Plaza Ferrándiz-Carbonell, 03801, Alcoy, Spain [b] Instituto de Estructura de la Materia, CSIC, Serrano 121, 28006 Madrid, Spain
Contact: belen.mate@csic.es

The increasing capabilities of space missions, like the James Webb Space Telescope, or ground-based observatories, like the European Extremely Large Telescope, demand high quality laboratory data of species in astrophysical conditions for the interpretation of their findings. We have measured new physical and spectroscopic data of solid methanol that will help to identify this species in astronomical environments. Methanol ices were grown by vapor deposition in high vacuum chambers. On one hand, ice densities were measured via a cryogenic Quartz Crystal Microbalance and laser interferometry. On the other hand, absorbance infrared spectra of ice layers of different thickness where recorded to obtain optical constants using an iterative minimization procedure. Finally, infrared band strengths were determined from infrared spectra and ice densities. Some discrepancies are found between our optical constants and those previously reported in the literature, for an ice grown at 10 K and subsequently warmed. The disagreement is explained as due to different ice morphologies. The new infrared band strengths agree with previous literature data when the correct densities are considered [Hudgins et al. 1993, ApJS, 86, 713; Bouilloud et al. 2015, MNRAS, 451, 2145; Luna et al. A&A, DOI:10.1051/0004-6361/201833463]

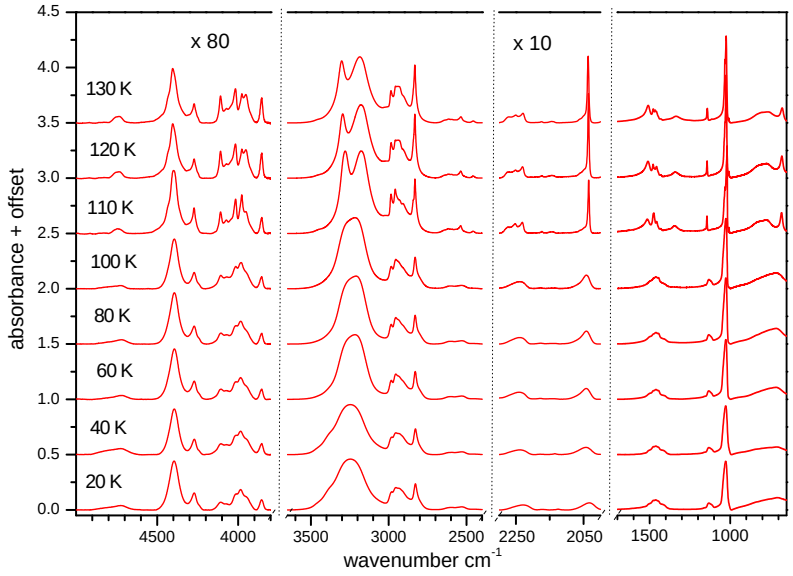

Figure 1: Infrared spectra of methanol ices layers of 990 nm grown at the indicated temperatures. Spectral regions with weak absorptions have been multiplied by a factor indicated in the figure.