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Infrared spectroscopy in the C–H stretching region towards embedded high-mass young stellar objects in the Large Magellanic Cloud

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Abstract. We report the results of infrared spectroscopic observations of embedded high-mass young stellar objects in the Large Magellanic Cloud. The CH_3OH ice absorption band as well as the 3.47 μm absorption band are detected toward the embedded sources in the LMC. The properties of these spectral bands in the low metallicity environment are investigated based on comparisons with Galactic embedded sources.

Keywords. astrochemistry, ISM: abundances, ISM: molecules, infrared: ISM, Magellanic Clouds

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Interstellar chemistry in low metallicity environments is crucial to understand chemical processes in the past universe. The Large Magellanic Cloud (LMC) is an excellent target to study such low metallicity interstellar chemistry thanks to its proximity and metal-poor environment. We analyze the 3–4 μm spectra for 11 high-mass young stellar objects (YSOs) in the LMC obtained by Infrared Spectrometer And Array Camera at the Very Large Telescope (Shimonishi *et al.* 2015). The present analysis also uses the infrared spectra presented in Shimonishi *et al.* (2008, 2010), which were obtained by the Infrared Camera on board *AKARI* (Onaka *et al.* 2007).

Solid methanol (CH_3OH) is an important component of ice mantles (e.g., Dartois *et al.* 1999). We found that the 3.53 μm CH_3OH ice absorption band for the LMC high-mass YSOs is absent or very weak compared to that seen toward Galactic high-mass YSOs. We hypothesize that grain surface chemistry at relatively high dust temperatures (warm ice chemistry) is responsible for the observed characteristics chemical compositions of ices in the LMC. The 3.47 μm absorption band is often seen in Galactic embedded sources, but the carrier of the band is still under debate (e.g., Allamandola *et al.* 1992). It is known that strengths of the 3.47 μm band has a positive correlation with those of the water ice band. We found a similar correlation for the LMC sources, but the LMC sources require a slightly higher water ice threshold for the presence of the 3.47 μm band. The results suggest that more shielded environment is necessary for the formation of the 3.47 μm band carrier in the LMC.

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