
FORMATION OF (PER)CHLORATES ON MARS

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Abstract

The origin of methane, perchlorates, chlorates and chlorinated alkanes on Mars has never been explained, even though their presence has been confirmed by the Viking and Curiosity Rovers several times. In our experiments (1,2), we performed photocatalytic reduction of CO₂ in presence of HCl over TiO₂, montmorillonite and the Nakhla meteorite and other catalysts by irradiating sample with UV for up to 3500 hours. After FT-IR and XPS analyses, we observed the formation of perchlorates, chlorates, methane and chlorinated methane. The experiment was performed at ambient temperature and at liquid nitrogen boiling point temperature. Based on these findings, we propose that this process may contribute to the observed presence of methane on Mars as well as perchlorates and chlorates. Furthermore, perchlorates are stable in Martian conditions and therefore could have accumulated on the surface for billions of years. We estimate that this mechanism would be sufficient to accumulate perchlorate in the Martian soil in 0.1 – 1 wt. % in 5 – 50 cm depth. This proposed gradient may be observed by Insight over, which is the substitute rover for Curiosity.

References:

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