The roles of polycyclic aromatic hydrocarbons in dark cloud chemistry: New constraints on sulphur-bearing species

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Abstract
The recent detection of c-C6H5CN in the dark cloud TMC-1 provides a new evidence of polycyclic aromatic hydrocarbons (PAHs) in dark clouds. However, knowledge of PAHs in dark cloud chemistry is still very limited. In this study, we investigate the effects of PAHs on the chemistry in dark clouds by coupling published PAH-related chemistry with a gas-grain reaction network. We found that abundances of some ice species, such as OCS, OCN, C2H5OH and HCOOCH3, are enhanced by more than two orders of magnitude due to the inclusion of PAHs in the gas-grain chemistry through accretion and subsequent reactions in ice. Especially, combining PAHs with gas-grain chemistry in dark clouds provides an alternative way to reach a good overall agreement of sulphur-bearing species in both the gas and solid phases using the cosmic value of sulphur. With the inclusion of PAHs, CS + O → OCS makes a contribution of ~5-10 per cent to solid-phase OCS together with CO + S → OCS (~80-90 per cent), depending on the initial abundances, chemical age and PAH parameters.

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