INCLUSION OF REACTIONS WITH BARRIERS IN HOT CORE MODELS

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Previous models of the low-mass star-forming region L1527 investigated the observations of long-chain unsaturated hydrocarbon radicals in a gaseous envelope with slightly elevated temperature of ≈ 30 K. These models gradually increased gas and grain temperatures from initially cold (10 K) conditions and demonstrated that the enhanced abundances could be explained by gas-phase ion-molecule chemistry following the evaporation of methane from warming grains. Further, the success of the fit was similar near $T \approx 30$ K if the warm-up was truncated at 30 K or allowed to continue upward toward larger temperatures representative of hot core conditions. A secondary conclusion indicated that the hydrocarbon radical species should remain in large abundance as the temperature grows to 200 K. The subsequent implication that these species might be detected in hot corinos and hot cores stands in contrast with the lack of detection toward such sources. As observational interest in low mass star formation grows, we have re-visited this issue. Primarily, we note that reactions between hydrocarbon radical chains and molecular hydrogen had been previously omitted from cold cloud models as irrelevant because of their non-zero activation barriers of $E_{\rm A} \approx 1000$ K. These reactions have been included in a revised network, and as a result the abundances of hydrocarbon radical chain species are directly reduced in the revised, extended warm-up models as temperatures exceed ≈ 70 K. This inclusion does not affect the quality of the previously reported agreement with observations of L1527 in "lukewarm" conditions.