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Laboratory Experiment on the Production of Perovskite by the Coalescence Between CaO and TiO2 Particle

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The new model calculation which present significant improvements upon the work of Tsuji et al. has been suggested that hundreds of grain species are included in the equation of state to allow the high temperature condensates that are most abundant in the atmospheres of late-type M dwarfs and brown dwarfs. The first dust grain species to form are ZrO2 for T $<$ 2000 K and corundum (Al2O3) for T $<$ 1800 K. Other stable species to appear at T $<$ 1600 K are Ca2Al2SiO7, Ca2MgSi2O7, and CaMgSi2O6, as well as Ti4O7 and Ti2O3. These grains all compete with the formation of the perovskite CaTiO3 and corundum. The condensation of perovskite is the principal cause of TiO depletion in the atmospheres of dwarfs later than about M6. CaTiO3 dusts are hardly produced in laboratory. In a previous paper, we produced crystalline forsterite dust by the coalescence between MgO and SiO2 smoke particle. In this experiment, CaTiO3 particles were directly produced by the coalescence growth between CaO and TiO2 smoke particles. Spherical particles with the size of 100-200 nm order were produced. We also produced massive amounts of perovskite powder in Ar gas (10 Torr). The optical spectra at 14.44 and 21.88 um can be identified as the perovskite. The evaporation source problem in laboratory experiment was also discussed on the formation of the perovskite.