

Silicate dust evolution in protoplanetary disks

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Silicate is the dominant solid component in circumstellar environments. Infrared spectroscopic observations have shown that both crystalline and amorphous silicate dust are present in protoplanetary disks, and crystalline silicate dust seems more abundant in the inner warm region of the disks. This suggests that thermal annealing of interstellar amorphous silicate dust occurred in the disk and changed the dust properties of disk dust temporally and spatially with disk evolution. Some of those processes occurred in the early Solar System may have been recorded in fine-grained matrices of less altered/metamorphosed chondrites, which contain abundant amorphous silicates and a small fraction of presolar silicate grains. Laboratory experiments help us extract the record of disk thermal processes from natural samples quantitatively. We have done experiments on crystallization and hydration experiments of amorphous silicates and evaporation and condensation experiments of crystalline silicates, focusing on kinetics of these processes. In this presentation, based on experimentally-obtained kinetic data, we will discuss the silicate dust evolution in protoplanetary disks.

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