Crystallization of Dust in Space

TETSUO YAMAMOTO

Inst. Low T emperature Sci., Hokkaido University

First, I will give a brief summary on the physics of elementary processes of crystallization from both theoretical and experimental sides. The elementary processes of crystallization consists of 1) nucleation of crystalline seeds in an amorphous medium (i.e. glass) and 2) growth of crystalline nuclei to macroscopic crystals. As a topic of crystallization of astrophysical dust, I will discuss crystalline silicate observed in various astrophysical objects. Since the first identification of crystalline silicate feature in comet Halley in the wavelength region of 8 to 13$$\mu$m (Bregman et al. 1987, Campins Ryan 1989), similar crystalline silicate features have been clearly observed in various kinds of objects including circumstellardust around evolved stars, in YSOs, in disks around young main sequance stars such as beta-Pic, and in zodiacal light. On the other hand, no crystalline feature has been observed in the dust in diffuse interstellar medium and molecular clouds (see Hanner 1999, Hanner & Bradley for reviews). I will review proposed mechanisms of crystallization of silicate dust in space, and propose a new nonthermal crystallization mechanism, which accounts for the observed 10$$\mu$m crystalline silicate feature. References Bregman, J. D., Campins, H., Witteborn, F. C., Wooden, D. H., Rank, D. M., Allamandola, L. J., Cohen, M., Tielens, A. G. G. M.1987, Astronomy and Astrophysics, 187, 616 Campins, H., & Ryan, E. V.1989, Astrophysical J.341, 1059 Hanner, M. S.1999, Space Science Rev., 90, 99 Hanner, M. S. & Bradley, J. P.2003, in “Comets” II, eds. ~M. ~Festou, H. U. ~Keller, H. A. ~Weaver, University of Arizona Press, p. ~555 Yamamoto, T. & Chigai, T.2006, Highlights in Astronomy, in press