EVAPORATION, CONDENSATION, ANNEALING AND MIXING OF DUST DURING DISK EVOLUTION. H.-P. Gail, and E. Lüttjohann. Institut für Theoretische Astrophysik, Univ. Heidelberg, 69120 Heidelberg, Germany (gail@ita.uni-heidelberg.de).

Introduction: Dust in preplanetary disks around young stars is a complex mixture of species with widely differing compositions and origins [1,2]. The inner part of the disk (<10 AU) is filled with a complex mixture of condensed phases formed under widely disparate conditions like that encountered in cold interstellar space and hot interior regions of accretion disks.

In order to understand observations of dust properties from accretion disks around young stars, remnant material from Solar System formation found in meteorites and cometary nuclei, and radial trends of chemical composition of bodies in the Solar System, it is necessary to model the composition of the dust mixture in preplanetary accretion discs as realistically as possible. We are presently developing model programs that allow a detailed calculation of all relevant chemical and mineralogical processes in time-dependent models of accretion discs. Parallel to this, laboratory investigations of annealing and evaporation/ condensation processes of the relevant materials are underway to determine the material properties that are required for model calculations.

Model calculation: We present new model calculations of the dust mixture in accretion disks based on a one-zone time-dependent α-disk model that is self-consistently coupled with the set of transport-reaction equations for dust processing in order to consider correctly the non-linear coupling between dust processing, dust opacity and disc evolution. The model considers amorphous and crystalline silicate dust (iron bearing silicates, forsterite, enstatite, quartz) and iron and carbon dust grains. Annealing, evaporation and condensation are considered for processing of mineral grains and combustion for carbon grains, similar as in [3]. A limited set of chemical reactions in the gas phase is also included. For dust particle and molecular species the model considers, despite being essentially a one-zone model, with respect to advection the layered accretion where matter flows outward close to the mid-plane and inward in higher layers [4]. This special flow structure found in rotating systems supports efficient mixing between widely separate zones of accretion disks [4,5].

Remarks: The model allows to calculate the distribution of Si, Mg, and Fe over condensed phases by solving the time dependent equations for the reaction kinetics of the processes. Though the abundances of the silicate minerals are not being strongly different from what one expects for a chemical equilibrium mineral mixture, there are some marked differences that result from the slowness of diffusion and crystallisation processes in solids that prevent that the processes evolve into equilibrium in the slowly evolving accretion disk.

References: [1] Wooden, D. et al. 2007, *Protostars & Planets V*, 815-833. [2] Watson, D.M. 2009, arXiv:0902.2744. [3] Gail, H.-P. 2004, *A&A* 413, 571 [4] Keller, C., et al. 2004, *A&A* 415, 1177-1185. [5] Ciesla, F.J 2009, *Icarus,* 200, 655-671.