Chemical formation routes towards silicate dust

David Gobrecht

OA Teramo, Italy

Although circumstellar silicate grains have been investigated and their spectral features are used to determine the chemical composition, mineralogy, size, shape, and temperature of the dust grains, its synthesis remains poorly understood.

Classical nucleation theory and thermodynamic equilibrium calculations have been used to predict the amount and composition of the dust components for oxygen-rich, S-type, and carbon-rich AGB stars (see e.g. Ferrarotti & Gail, 2006).

However, circumstellar AGB envelopes are periodically crossed by pulsational shocks and thus, an active non-equlibrium chemistry is ongoing in the post-shock gas, affecting the prevalent molecules (CO, H_2O, SiO, SiS, CS, HCN, SO, SO_2, TiO, NaCl) as well as the cluster and dust formation.

We present results on molecules, dust clusters and grains by using a chemical-kinetic reaction network coupled to a condensation routine and finally, we derive masses and grain size distributions for alumina and silicate (enstatite and forsterite) dust.

The results for the prevalent molecules, the dust-to-gas mass ratios and the dust location agree with the most recent observations, despite the model grain sizes are rather low (~ 0.04 μm).