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Development and physical reason of IR spectral features during condensation and solid phase reactions of Fe-Mg silicate systems

Tamanai*, A., Wetzel, S., Pucci, A., Gail, H.-P., R. Dohmen, *Kirchhoff Institute for Physics, University Heidelberg, Im Neuenheimer Feld 227, D-69120 Heidelberg akemi@kip.uni-heidelberg.de

The various Fe-Mg silicates are one of the most important dust components in space and are essential ingredients for the formation of terrestrial planets. Model calculations of dust grain condensation anticipate that in contrast to Mg-rich silicate condensation under equilibrium conditions, Fe-rich silicate condensation occurs under non-equilibrium conditions [1]. However, no details of the silicate formation processes concerning the Mg/Fe proportion are known. Hence, investigations of the iron content of silicates by analysis of observed spectra are of particular importance to pin down the composition of the precursor material of planets. For this we have experimentally performed in-situ IR spectroscopic transmission measurements during the condensation of layers produced by evaporation of Fe, Mg, MgO, and SiO under UHV conditions in order to deepen the understanding of silicate dust grain evolution and transition. In particular, the influence of the iron content on the 10 μm Si-O stretching vibration band was carefully addressed in our experiments.

[1] Ferrarotti, A.S. & Gail, H.-P. (2001), A&A 371, 133-151

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