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Amorphous semi-solid and solid states in organic aerosol particles

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Knowledge of the phase state of aerosol particles is of fundamental importance for understanding many atmospheric processes including heterogeneous chemistry and cloud formation. Up to now, most work has been focussing on liquid and crystalline phase states; however, recent work has shown that organic particles may also exist in amorphous semi-solid or solid (i.e. glassy) states. In this overview talk, the evidence for such proposals is presented. The formation of amorphous semi-solids and glasses from organic compounds as well as their properties are reviewed in general terms. Several structure-activity relationships are analysed and applied to organic compounds typical of secondary organic aerosol components. Furthermore, the effects of hygroscopic water uptake are discussed. Moreover, I speculate about implications for atmospheric multi-phase processes, in particular heterogeneous chemistry, aerosol lifetime, and cloud formation. The talk concludes with an assessment of the current state of knowledge and proposals for future studies to resolve existing uncertainties.