Homogeneous Nucleation of Zinc Vapor

Name and Surname :	**Rütten Frederik**	Name of PhD's manager(s):	**Prof. Dr. A. Wokaun** **Dr. I. Alxneit** **Dr. H.-R. Tschudi**
Speciality/ Degree :	**Dipl.-Chem.**		
		Laboratory name :	**Solar Technology Laboratory**
PhD starting date :	**15.09.2005**	Laboratory address :	**Paul Scherrer Instiute** **5232 Villigen PSI** **Switzerland**

For the optimization of the thermochemical water splitting cycle based on the redox pair Zn/ZnO fundamental understanding of the nucleation and condensation process of zinc vapor is needed to optimize the separation of zinc and oxygen at the exit of a high temperature solar reactor.

To obtain kinetic data for the nucleation and condensation of zinc vapor an experiment based on a Laval nozzle was build. Nucleation and condensation are induced by an adiabatic, stationary expansion of zinc vapor and nitrogen as an inert carrier gas through an optically transparent Laval nozzle. A laser beam propagates along the axis of the nozzle and the light scattered by the droplets is detected perpendicular to the nozzle axis. By using an intensified CCD camera the scattered laser light can be detected spatially resolved.

A numerical model is used to describe the central part of the flow along the nozzle's axis. This model incorporates the laws of fluid dynamics as well as the nucleation and condensation process. It predicts the particle size distribution at every position along the nozzle axis. Assuming Rayleigh scattering the intensity of the scattered light can be calculated from the second momentum of the particle size distribution.

Experiments to verify the measurement principle and data analysis were performed on n-butanol for which a solid data basis is available from the literature. Afterwards the setup was modified to allow measurements with zinc vapor at 1200 K and pressures up to 10 kPa. First experiments using zinc vapor will be performed soon.