# Kinetics of water induced structual transformation in ZnS nanoparticles

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Processes such as inter-particle interactions and the adsorption of ions to surfaces have been shown to induce internal ordering in nanoparticles. For example, the aggregation and disaggregation of 3 nm ZnS nanoparticles drives a reversible structural transformation [1]. In addition, it was shown in both experiments and simulations that adsorption of water to ZnS nanoparticle surfaces leads to an irreversible increase in structural order [2]. However, because water adsorption also induces aggregation, the kinetics of the water adsorption-driven transformation are difficult to evaluate. In order to separate the effects of adsorption and aggregation and to determine the activation energy for the adsorption-driven reaction, we fixed the aggregation state by vacuum-drying nanoparticles before exposure to water vapor at different temperatures. The aggregation state and particle size remained constant throughout the tranformation, but the ordering of the particles showed a marked increase. The results confirmed that the adsorption of water molecules is a stronger determinant of the nanoparticle structure than the aggregation state. These results have implications for water limited environments such as hydrophobic organic rich regions and low water activity extra terrestial environments.

**References**

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