

Nucleation and thermodynamics of free clusters

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A novel experimental setup has been developed, which allows controlling the sticking of atoms onto mass selected clusters [1]. It has been applied to sodium clusters so far. The sticking scaling law as a function of the cluster size has been measured for the first time [2]. Beyond the measurement of sticking cross sections, controlled sticking experiment is a powerful tool for determining some thermodynamic properties of clusters. By controlling accurately the collision energy, the caloric curve is deduced from the average number of atoms that can be stuck onto the cluster as a function of its temperature. Unambiguous results are obtained by using a differential scheme. Melting temperatures and latent heat of sodium clusters are, as far as data are available, in good agreement with previous measurements [3]. Nevertheless, our caloric curve for Na_{41}^+ shows a previously unobserved double structure attributed to surface melting. The marked size dependence of melting temperature of clusters has already been extensively analysed. However, in light of a simple two level model, one might also rightfully ask why melting temperatures do not vary much more than they do. Similar experiments on water cluster are in progress.

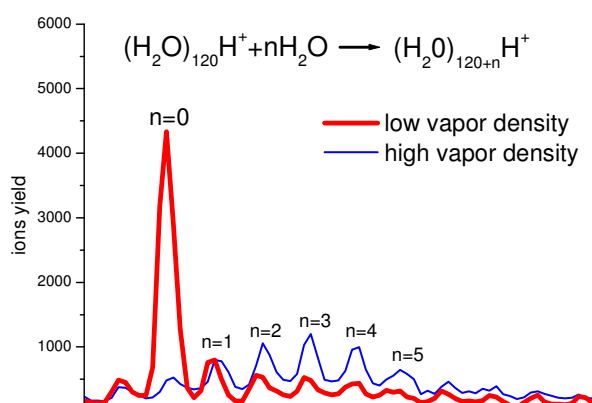


Figure 1: sticking mass spectra of water molecules stuck onto a water cluster.

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- [3] H.Haberland,T.Hippler,J.Donge,O.Kostko,M.Schmidt B.von Issendorf, *Melting of sodium Clusters : Where do the Magic Numbers come from?* Phys.Rev. Lett. 94, 035701 (2005)