Phase separation in binary rare gas mixtures

J. Meier, M. Heitz, G. Wittich, J. Classen, S. Hunklinger
Kirchhoff-Institut für Physik, Universität Heidelberg, D-69120 Heidelberg, Germany

The phase diagram of pure rare gases is quite simple and well understood, whereas the behavior of binary mixtures of Lenard-Jones particles is much more complex. In thermodynamic equilibrium, theoretical models predict an eutectic or aceotrope phase diagram if the two kinds of particles are similar in size. In contrast, for a smaller ratio of the diameters separation in several phases is expected.
We have investigated the desorption behavior of quench-condensed pure neon and argon films and of Ne_xAr_{1-x} mixtures with high frequency surface acoustic waves and a low frequency silicon double-paddle oscillator. The desorption behavior of pure films is rather simple: As expected, neon desorbes at 8 K, and argon at 30 K. In contrast, mixtures of neon and argon exhibit a more complex behavior. While for small and very large concentrations x a behavior similar to that of pure films is found, an additional release of neon is observed at 20 K for concentrations $0.25 < x < 0.92$. The occurrence of a neon desorption temperature of 20 K indicates the formation of energetically more favorable structures. Experiments with different concentrations have shown that regions with a composition of either AB_2 or AB_3 are generated. For $x < 0.25$ and $x > 0.92$ the results are consistent with the existence of a substitutionally disordered solid.