Nanostructured Soft Materials 1
V. Körgstgens, P. Müller-Buschbaum
Lehrstuhl für Funktionelle Materialien
Physik-Department, TU München, Garching

Exercises given by Kerstin Wienhold
Kerstin.wienhold@ph.tum.de

Exercise 2
To be discussed on 30.10.2018

1.)
Nanoparticles feature special characteristics dependent on their size. How does a blend of nanoparticles of small, medium and big size behave upon heating? Sketch the dependence of melting point on the size of a nanoparticles.

2.)
Self-assembly is a spontaneous association of molecules into defined 3D geometry. The self-assembly process involves attractive and repulsive forces. Give examples for repulsive and attractive intermolecular forces (=forces between particles). In addition to intermolecular forces, intramolecular bonding plays a big role for the properties of a materials. Which types of bonding can be distinguished? Explain them shortly and give examples.

3.)
The potential energy between two atoms can be approximated with the Lennard-Jones potential: \( V = 4\varepsilon \left[ \left( \frac{\sigma}{r} \right)^{12} - \left( \frac{\sigma}{r} \right)^6 \right] \) with \( \varepsilon \) and \( \sigma \) as constants.

   a) Sketch the Lennard-Jones potential and mark \( r_0 \), \( \varepsilon \) and \( \sigma \).

   b) Calculate the distance \( r_0 \) for the minimum of the potential.

   c) Calculate the corresponding minimum of the potential \( V_{\text{min}} \).