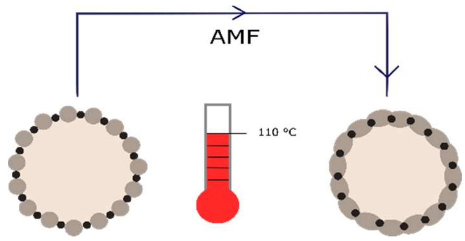

The ongoing challenge in a great variety of fields has become to deliver active ingredients, e.g. drugs, pesticides or fragrances, to the point of interest and release them with high precision. There is a possibility to form capsules containing actives that can be released, e.g. in the area of the body affected by cancer, when utilizing in medicine. In terms of efficiency, it is demanded to search for new solutions how to fabricate a large number of capsules with narrow size distribution. One possible route is to use particle-stabilized emulsions (Pickering emulsions) as precursors for colloidal capsules. In such emulsions, droplets are coated by a dense layer of solid particles. After chemical or physical treatment, this layer can transform into the impermeable coating that protects capsulated substances, for instance, medicinal substances.

Sintering of particle layer is one of the possible approaches for fabricating capsules from Pickering droplets as templates. When exposed to high temperature, particles susceptible to the thermal treatment undergo glass transition; during the heating, they fuse partially and form an impermeable layer around a droplet. This layer is more rigid comparing to the layer of non-sintered particles. The high temperature that allows for capsulation of a droplet can be achieved when Pickering droplets are immersed in a boiling solution. In that case, the temperature increase is global and the whole system is heated due to the external energy source. However, there are methods where temperature rise can be more local, e.g. magnetic heating. Magnetic particles placed in the alternating magnetic field (AMF) become local sources of heat. It is due to the magnetic energy dissipation as a result of relaxation and hysteresis.

The presented project aims to investigate the magnetic heating of emulsions stabilized both with magnetic particles and others, e.g. polystyrene, organic in origin, that are susceptible to the application of high temperature and undergo the glass transition. The efficient process of heating will result in the formation of colloidal capsules from Pickering emulsions. Fabrication of stable emulsions involves the ultrasonic homogenization and coalescence of non-completely covered droplets under the electric field. In this way, there is a possibility to control the final droplet size as it depends on the concentration of particles used to stabilize the system. Moreover, by using magnetic heating w suspension of magnetic particles, there is also possible to form capsules from single Pickering droplets due to the temperature rise in a suspension where the droplet is immersed. The magnetic particles included in the capsule coating can offer a new application – a controlled change of capsule position by using a gradient magnetic field. My research will include optical observation during a process of Pickering emulsion formation and characterization of final capsules. For bigger objects, the measurements in the electric field will provide knowledge about the rigidity of coating what is evidence of successful capsulation. In order to control smaller capsules, there is a need to develop the different techniques for testing, for instance utilizing non-destructive ultrasound methods.

The scope of my research concerns the fabricating and testing materials that are able to be utilized for the development of food, agricultural and cosmetic industry in the future, and medicine, as well. In particular, the development of applicable medical procedures has gained great interest for the last decade. The proposed study will allow us to actually explore the process of magnetic heating in the context of a fabrication of colloidal capsules and indicate its potential.