The aim of my project is to describe high-pressure behavior of γ-cyclodextrin based metal-organic frameworks (CD-MOFs).
This relatively new and still not-thoroughly studied group of compounds is the first example of an edible metal-organic framework.[1] Thanks to its unique structure and easy synthesis it has gained lots of interest from scientists and industry.[2,3] They can be used as dehumidifiers, for gas sorption and storage, or even for electrical information storage.[3] Since they are composed only of γ-cyclodextrin molecules and potassium ions they are non-toxic[1] and therefore might be applied in food and pharmaceutical industries. Especially the last one can be interested in this group of materials if used for drugs encapsulation. Free cyclodextrins have been applied in the similar way for many years.[4] High porosity and resulting high capacity of studied compounds might be very important and desired in designing molecular containers for biologically active compounds. Moreover, high pressure will significantly broaden the research spectrum of the project. Performing experiments with diamond-anvil cell[5] will allow studying CD-MOFs at non-ambient conditions. Research results from last decades show how chemical compounds under high pressure change their structures, undergo phase transitions or even gain new properties.[6-10] Obtaining new polymorphs or co-crystals of known, biologically or industrially important compounds not only broadens our knowledge about them but also might lead to their new practical applications.
The basic research performed in this project will show how an external stimulus, high pressure, influences the crystal structure and therefore the properties of CD-MOFs. It will enable determination of their pressure stability and provide information about adsorption of organic compounds (solvents and drugs). If high-pressure forms will be preserved after they return to ambient conditions it might be possible to employ their structural properties for new interesting applications. Gathered data and information are crucial not only for the better understanding and broadening our knowledge about this new type of materials, but also will help to precisely determine their restrictions and therefore their potential use.
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