Salts of $[BH_3NH_2BH_2NH_2BH_3]^-$ anion as cubic boron nitride precursors and ionic conductors.

Boron nitride is a two-element compound with chemical formula BN. In the periodic table, boron and nitrogen are found in the same period (row) on both sides of carbon. Therefore, BN is an analogue of carbon (it has the same number of electrons per atom); and as a result both materials exhibit profound similarities. BN exists in several crystalline forms analogous to those created by carbon, *i.e.* h-BN is an analogue of graphite, c-BN – diamond, w-BN – lonsdaleite. For example, c-BN and diamond, can found similar application fields, such as for grinding and as abrasive materials because of their outstanding hardness, making them both members of the group of superhard materials. As such, boron nitride is not only interesting compound from the chemistry point of view, but also a material highly desirable in the industry.

For the first time BN was synthesized over one and a half century ago. Its synthesis requires quite harsh conditions. h-BN is usually obtained at high temperature over 900°C. c-BN synthesis requirements are even tougher. It is synthesized from hexagonal boron nitride requiring high temperature exceeding 1900°C and high pressure nearly 7.7 GPa (pressure *ca.* 77 000 times higher than atmospheric pressure). These numbers can be a bit lowered using various catalysts. In spite of these harsh conditions, BN is widely used material with estimated yearly production exceeding 300 tons. Even though c-BN exhibits somewhat smaller hardness than diamond, it surpasses its carbon analogue in mechanical applications. It is because of its superior chemical inertness with respect to iron group metals (which is important when processing steel), and better stability in high temperature conditions. Therefore, for some purposes, it is a better candidate for engineering material than diamond.

The project aims at synthesis of c-BN via heating and thermal decomposition of novel precursor materials with and without catalyst addition. Two promising precursors were chosen for this purpose: lithium and ammonium salt of a longish $(BH_3NH_2BH_2NH_2BH_3)^-$ anion. All of the known salts containing this anion were for the first time synthesized and characterized in our laboratory. Aforementioned precursors were chosen since they seem to be very promising; for lithium salt we have already found disordered h-BN in decomposition residues at a mere 200°C. It was quite surprising taking into consideration other hexagonal boron nitride synthesis methods, usually requiring much higher temperatures. Here we want to investigate the catalyst influence on thermal decomposition and the quality of BN product. Ammonium salt was chosen since it exhibits B:N molar ratio equal 1:1, the same ratio as in boron nitride. Therefore it should be ideal for synthesis of pure boron nitride.

Successful realization of project goals could result in novel, simple, one-step synthesis of c-BN in relatively mild conditions. Such method might be applicable in industry in the future. The research, comprising synthesis of new compound, will contribute to the development of chemistry based on boron and nitrogen.