It is well known that hard magnetic materials are widely used in various fields of technical industry such as permanent magnets or data recording media in computer technologies. Nowadays, in the field of hard magnets ternary compounds of type Nd-Fe-B (in the form of sintered powder) are considered as the best. Indeed, the value of coercive field is of about 1.2 T and the parameter $|BH|_{max}$ can reach values of about 400 kJ/m^3. Recently, one can notice a trend towards searching new hard magnetic materials with a reduced content of rare earth (RE) elements or some other systems free of these ingredients that have an obvious economic meaning.
Recently, in the literature, one can notice a trend towards searching new hard magnetic materials with a reduced content of rare earth (RE) elements or other systems free of these elements at all - such as Fe-Pt. The reason is obviously of economic nature due to a relatively high price of RE compounds.

Recently we have reported ultra-high coercivity of Fe-Nb-B-RE bulk nanocrystalline alloys i.e. 8.6 T at the room temperature. It should be underlined that in the field of bulk materials this is a unique feature, giving new opportunities to designing new magnetic materials as well as to studying magnetization processes in the alloys in question. It was shown that the examined alloys contain some ultra-hard magnetic objects that do not directly contribute to the magnetization precesses but, via direct interactions, can influence magnetic characteristics of the whole alloy. A disadvantage of the alloys is relatively low magnetic saturation that narrows down application spectra. However, the idea is to use the ultra-hard magnetic phases in composites containing different magnetically coupled objects.

It seems that the occurrence of the ultra-high coercive objects, at the room temperature, can be a starting point for designing new magnetic composites with mew and unique properties. For example, interactions between these and other less hard phases should lead to an enhancement of hard magnetic properties, i.e., increase of magnetic remanence and the $|BH|_{max}$ parameter as a compromise with the decrease of coercivity. Taking into account that in our case starting values of H_c are very high, one may predict discovery of new permanent magnets with reduced Re content or alternatively, new class of materials with high resistance to an external magnetic field. However, the main problem is to study study an influence of phase composition and interactions between them on magnetization processes in the systems containing high-coercive phases.
The aim of the project is the study magnetic interactions in composites containing different phases with different magnetic properties. Special attention will be payed for the systems with soft, hard and ultra-high coercive phases. Direct interactions between these phases can lead to an optimization of magnetic properties required for different applications. The key point is understanding an influence of the phases content and its possible coupling on magnetization processes. On the present state, one may formulate a hypothesis that it is possible to use the ultra-hard magnetic objects and they interactions with the other magnetic phases in order to designing new magnetic composites with characteristics better that for the classical permanent magnets but with reduced RE content.

Positive results of the project allow broadening the knowledge about optimization of hard magnetic properties of magnetic composites containing ultra-high coercive phases. Moreover, significant reduction of the RE content in permanent magnets can solve the global problem of restricted RE resources and can lead to decreasing prices of many popular electric devices like motors or generators.