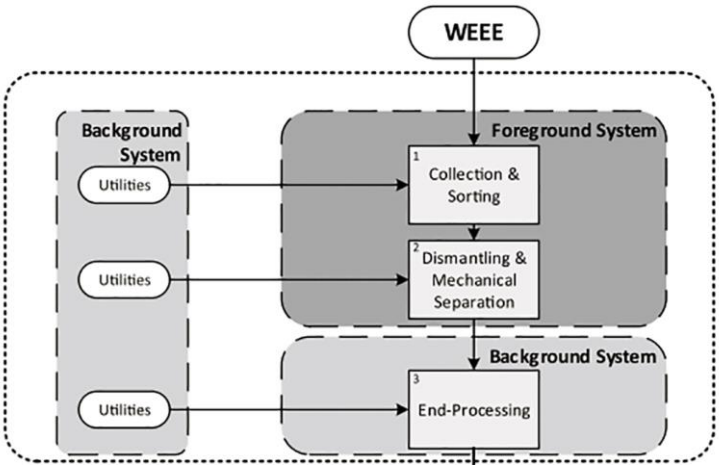
National Institute of Materials Physics (NIMP) is a Romanian research and development organization with an extended expertise in the field of Condensed Matter and Materials Physics (fundamental processes and applications) and with a well-established national and international reputation. It is organized in 5 research laboratories corresponding to five main research directions (Multifunctional Materials and Structures, Magnetism and Superconductivity Nanoscale Condensed Matter, Optical Processes in Nanostructured Materials and Atomic Structures and Defects in Advanced Materials).

As a consequence, the students will have the opportunity to work in any of these departments, after a general training in safety issues and introduction regarding critical raw materials. Given the specifics of the activity, the training will be focused on the routes of recovery
for some critical materials, as well as on the last research directions for their reduction or replacement in high-tech applications.

At NIMP the students will begin a **general training** on:

1. Introduction to main fundamental notions (Chemistry and Physics) for describing critical raw materials (2 h lecture with slides),
2. Introduction to main high-technology applications requiring critical raw materials (2 h lectures with slides and videos),
3. Free discussions on scientific supports for their use in such applications. Physical and chemical aspects (2 h),
4. Introduction to the type of waste and waste roadmap (2h lecture with slides). Case studies: (i) Recycling of used batteries, (ii) Recovery of plastic and metals from WEEE. (lecture with slides, 2h)
5. Driven reasoning for possible replacements in high-tech and industrial applications. (2 h)
6. General principles for physico-chemical analysis of compounds containing critical raw materials. (2 h with slides)
7. Introduction to safety regulations and procedures for working in laboratories. (2 h with slides)

Examples of gained abilities: factual and scientific-driven reasoning, basic understanding of diagrams depicting industrial processes, general competences as improved oral and written communication in English, team work and time management to answer questions and solve assignments.



Three main steps are necessary in any waste recycling activity of waste (WEEE):

(i) ***Collection and sorting***, with improved results upon manual sorting;
(ii) ***Dismantling*** and ***physical/mechanical separation and crushing*** (primary or (pre-)treatment)
(iii) ***End-processing*** and ***recycling.***

Experimental work:

Hands-on training on 2 types of activities: (i) introducing catalysts based on non-critical elements, and (ii) permanent magnets with reduced RE (rare earth) content.

1. Preparation and subsequent processing of nanoparticulate systems with spinel-like or perovskite-like structures. (2 days)

2. Morpho-structural and elemental characterizations. (2 days)

3. Preparation of amorphous ribbons with reduced RE content and subsequent crystallization process for improving their magnetic properties. (2 days)

4. Morpho-structural and magnetic characterization. (2 days)

5. Illustration of preparation-characterization cycles for optimization of desired properties (4 days).

Additional activities: Visit at the NIMP institute facilities.