

SYNTHESIS OF L₁₀-MnAlC BASED COMPOSITES AND L₁₀-FeNi PHASE UPON DESIGN OF CUSTOMIZED SOFT MAGNETIC ALLOYS BY MELT-SPINNING AND MECHANICAL ALLOYING (NEXUS)

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NEXUS aims at substituting the most powerful permanent magnets (PMs, mainly NdDyFeB) with rare earth (RE)-free PMs with the ordered L₁₀ structure (L₁₀-FeNi and L₁₀-MnAl), using elements widely available in Europe, by combining physics, materials science, engineering and chemistry under the common frame of nanoscience. The challenge proposed in *NEXUS* requires of the interaction between the two Subprojects in order to achieve the final objectives: development of two different L₁₀ MnAl-based materials (nano-engineered single phase L₁₀-MnAlC and MnAlC-based nanocomposite), artificial synthesis of the L₁₀-FeNi phase in a feasible timescale, and fabrication of magnets preserving the L₁₀-phase without degradation of the ordered structure. Subproject 2 will be developed by the Group of Research in Materials and Thermodynamics at Universidad de Gerona (UdG), with an extensive experience on the production and functional characterization of soft magnetic Fe-based materials and Mn-Al alloys. In addition, this project will allow advancing in innovation for the Spanish company IMA-Barcelona.

UdG group participates in the following *NEXUS* general objectives:

1. Development of an efficient exchange-coupling between the L₁₀-MnAlC phase (hard) and specifically designed soft magnetic materials in order to increase further the magnetization (and, in particular, remanence to enhance the resulting (BH)_{max}). [UdG]
2. Synthesis of the L₁₀-FeNi phase in pure form in the laboratory to enable the substitution of the strongest permanent magnets nowadays (sintered NdFeB). Reported studies are not succeeding the synthesis of more than about 10-13 % of L₁₀-FeNi in their samples. [UdG and IMDEA]
3. Establishment of an accurate measurement protocol to identify the content and ordering degree of the L₁₀-FeNi phase (e.g confirmation of the L₁₀-FeNi phase and ordering degree). This will solve the shortcomings frequently incurred by published studies dealing with the study of the L₁₀-FeNi phase. [UdG and IMDEA]

