Publishable summary

The TERAMAGSTOR project aimed through a “systems approach” at designing, fabricating and testing future perpendicular magnetic storage media with areal density larger than 1 Tbit/in^2. To overcome the technological barriers limiting the areal density, the proposed approaches addressed both key media feasibility issues (thermal stability, writability, signal to noise ratio) and low-cost, **high-throughput media** fabrication methods.

The approaches were based on the development of advanced film media based mainly on the system Fe(Co)Pt, of the type exchange-spring gradient media (exchange spring and percolated media), nanolithographically patterned and nanoparticles media patterned by templates or self-assembled through an integration of professional skills (chemists, physicists, engineers, materials scientists).The activity covered media preparation and characterisation, magnetization reversal processes, numerical micromagnetic simulations, measurements of write/read recording characteristics and signal modelling and processing.

The **TERAMAGSTOR** project focused on the most critical issues as defined in the International
Roadmap for recording media :

√ **Novel materials** for terabit magnetic storage storage.
√ Systematic investigation of the **fundamental physical properties** of magnetic-storage materials with the aim of increasing the storage density and ameliorating the degradation caused by cycling.
√ Investigation of **terabit-storage mechanisms** in solid-state materials and identifying new suitable materials
√ **Computational modelling and experimental verification** of magnetization reversal,stability and reliability of terabit storage materials.
√ **Novel analytical nanostructuration and characterization methods** for materials used in magnetic storage

For the **third** period of the project we achieved all the deliverables and milestones, with emphasis on optimization of selected candidate structures with the potential of sustaining recording of 1 Tbit/in^2, namely the development of fabrication and characterization of thin film media based on Fe(Co)-Pt $L1_0$ type structures, the optimization of the fabrication of FePt nanoparticle filled nanostructured membranes, development of the first large area nanostructured substrates by NIL or EBL with dot size in the sub-30 nm range , giving densities in excess of 1 Tbit/in^2 and finally the magnetic characterization of all samples. Test runs were performed of the magnetic recording characteristics on continous and nanopatterned samples. A web site was maintained (www.teramagstor.eu) with a lot of information.

The **innovation** and the ultimate goal is to produce the first EU 1.8 /2.5 “ HD with density in excess of 1 Tbit/in^2 , through synergistic approach using EU groups and the exploitation by the two IND has been achieved in a constricted area on the surface of a 2.5 “ disk . The **expected impact** of TERAMAGSTOR is to open the way to a new generation of ultrahigh density magnetic recording media, through a basic investigation of magnetic phenomena in the nanoregime and the development of new fabrication processes, favouring the EU technological progress and competitiveness in the key technological area of magnetic storage and in general to the ICT business.