The addition of Cr to Fe-based metallic glasses shifts the ferromagnetic-paramagnetic transition of the amorphous phase due to the magnetic domain structure and magnetic anisotropy distribution, bringing the Curie Temperature to below 40 °C. This makes these materials very useful for temperature sensors and for biomedical applications, and for other applications where they are used as the active elements in magnetic-sensitive sensors. In this investigation we use transmission electron microscopy (TEM) to study the microstructure of Fe_{67.7}B_{20}Cr_{12}Nb_{0.3} ribbons in relation to a range of thermal treatments. As-cast ribbons are prepared by rapid quenching from melt into the amorphous state. The ribbons are then annealed at temperatures below, close to and above the crystallisation temperature of 510 °C. Magnetic ribbons pose an interesting problem for TEM specimen preparation due to their very small dimensions. Typically 1-2 mm wide and 25 microns thick, traditional methods of preparation are usually avoided in favour of focussed ion beam (FIB) techniques. Using FIB and a Zeiss Libra 200MC microscope, we are able to investigate the evolution of the microstructure, specifically the formation of nano-clusters and nano-crystals, with annealing temperature. This allows an interpretation of the magnetic properties of the ribbons, in particular the magnetization and magnetic susceptibility. Cr and Fe atoms are found to segregate into nano-clusters of a few nanometres size, and the nano-crystalline grain size increases with annealing temperature.

Acknowledgement: This work was supported financially by the European Commission (FP7-REGPOT-2012-2013-1, Grant Agreement no. 316194, NANOSENS) and by a CNDI-UEFISCDI grant, Project No. 148/2012 (HYPERTHERMIA).