Magnetic alloys based on MnFeSn ternary intermetallic compounds for applications on thermomagnetic motors

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Finding a renewable energy source which diminishes the world dependence on fossil fuels is immediately needed. The thermomagnetic motors can work with renewable energies (e.g. heat from geothermal and solar sources) and also with industrial thermal rejects. The magnetic materials to be used in thermomagnetic motors are the ones that have high saturation magnetization and Curie temperatures above room temperature tunable through composition. Previous studies indicate that the alloys from the MnFeSn system based on the intermetallic compounds $Mn_{3-x}Fe_xSn$ and $Mn_{2-x}Fe_xSn$ are very promising candidate materials for application in thermomagnetic motors. Our study of these alloys concentrated in these compounds systems with x between 0 and 1,25, and our first objective was to obtain an alloy with Curie temperature specifically equal to 53°C and with high saturation magnetization, to be applied in a thermomagnetic motor working with a hot source provided by planar solar concentrators, which give temperatures between 80^{O}C and 90^{O}C. The $Mn_{3-x}Fe_xSn$ and $Mn_{2-x}Fe_xSn$ systems with x between 0 and 1,25were investigated using magnetic measurements, X-ray diffraction and scanning electron microscopy equipped with an Energy Dispersive Spectrometer (EDS). The X-ray data were refined by the Rietveld method using the Topas software from Brucker. The results indicate that for application in thermomagnetic motors working with planar solar collector the specific compounds $Mn_{1.85}Fe_{1.15}Sn$ and $Mn_{0.84}Fe_{1.16}Sn$ alloys with Curie temperature of 53°C are appropriate, and that for $x > 0.75$ (??) the compounds $Mn_{3-x}Fe_xSn$ and $Mn_{2-x}Fe_xSn$ have Curie temperatures varying from 70^{o}C (?) up to 150^{o}C (?), so that they provide cheap and very convenient materials for thermomagnetic motors working with higher temperatures of the hot source.