

<b>Improving Functional Metallic Materials Properties using Microstructure Control</b>		
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<b>Keywords</b>	Metallic material properties-related (26010)	

<b>Research Topics</b>
<ul style="list-style-type: none"> <li>· Improving workability and magnetic properties in NiMn-based metamagnetic shape memory alloys</li> <li>· Improving of workability and magnetic properties in rare earth-free Mn-based permanent magnet materials</li> <li>· Phase stability of Co-based Heusler-type shape memory alloys</li> </ul>
<b>Research Seeds</b>
<p>Because a large magnetic field-induced strain (MFIS) was reported for Ni<sub>2</sub>MnGa single-crystalline alloy in 1996, ferromagnetic shape memory alloys (FSMAs) have received much attention as high-performance actuator materials.</p> <p>Our group has identified an unusual type of FSMAs in Ni-Mn-X (X = In, Sn and Sb) based Heusler alloy systems, which show a drastic change of magnetization by martensitic transformation from the ferromagnetic parent phase to the very weak magnetic martensite phase. The martensitic transformation temperatures of these alloys are drastically decreased by an applied magnetic field, and the magnetic field induced transformation (MFIT), which is a kind of metamagnetic phase transition, has been confirmed in the martensite state near the martensitic transformation starting temperature <i>M<sub>s</sub></i>. Moreover, an almost perfect shape memory effect is induced by a magnetic field: the metamagnetic shape memory effect. Accompanying this martensitic transformation, giant magnetoresistance (GMR) and strong magnetocaloric effects (MCE) have also been reported. These alloys therefore show promise as new magnetic materials that are truly multifunctional.</p> <p>However, the high cost of NiCoMnIn alloys due to expensive In and the brittleness of both NiCoMnIn and NiCoMnSn alloys in polycrystalline form are some of the major concerns for the insertion of these materials in practical applications.</p>
<b>Related Technology</b>
<ul style="list-style-type: none"> <li>· Melting furnace (Frequency induction melting, Arc melting)</li> <li>· Magnetization measurement (VSM)</li> <li>· Thermal analysis (TG-DTA, DSC)</li> </ul>