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Magnetic shape memory materials: Scientific background and practical horizons

New multifunctional materials, called magnetic shape memory alloys (MSMAs), comprise those off-stoichiometric Heusler-type X_2YZ compounds (where X and Y are transition metals and Z belongs to the III-V group in the periodic table of elements), which exhibit martensitic transformation (MT) accompanied by a complex magnetic reordering. Due to strong interactions between structural and magnetic degrees of freedom in the vicinity of MT, they exhibiting giant properties, such as magnetic field induced strain, magnetoresistance, inverse magnetocaloric effect alongside conventional shape memory and superelasticity effects. These properties can be easily tuned by the composition variation, doping or heat treatments. MSMAs are cost-effective, rare-earth-element free and nontoxic. They can be conventionally divided into two major groups: ferromagnetic shape memory alloys (FSMAs), such as prototype Ni-Mn-Ga, especially suitable for actuation, and the metamagnetic shape memory alloys (MetaMSMAs), such as Mn-rich Ni-Mn-X ($X=In, Sn, Sb$), particularly important for magnetocaloric applications. Both types of materials are

capable to efficiently transduce the thermal, mechanical and magnetic energies into each other under conjugating fields producing cross-linked effects on both macro- and micro-(nano)scale. In this talk, we introduce the underlying physical mechanisms responsible for such energy conversions and the origin of the related performances of these materials. A broad range of the possible applications, such as actuation, sensing, energy harvesting and ferroic cooling will be reviewed

Speaker Biography

Volodymyr Chernenko has completed his PhD at the age of 26 years from Moscow State University, Russia. He is the Ikerbasque research professor at BCMaterials & University of Basque Country. He has 38 years of research experience in centres in Ukraine, Germany, Japan, Italy, United States, France, Switzerland, Australia, Spain, Hong Kong and Russia. He is the author and co-author of 14 patents and 315 original papers in ISI scientific journals and 5 book chapters with more than 8400 citations and h-index equal to 46 (Google Scholar). He is an International fellow awardee of the Helmholtz Association (Germany) since 2014. He is world-wide known as one of the founders of the new research area "Ferromagnetic shape memory alloys" being organizer and/or invited speaker of many International conferences.

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