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Editorial

Special Issue "Intermetallic Compound"

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This Special Issue collects ten articles related to the broadly understood physical properties of intermetallic compounds. The most important results of individual articles are presented below.

In the first article [1], the authors present experimental studies on the reduction of neodymium from a fluoride–chloride salt mixture, KCl–NaCl–$CaCl_2$–NdF_3, melted in a shaft electric furnace at different temperatures. The influence of technological parameters on the degree of extraction of neodymium was evaluated. It was experimentally proven that when zinc is added to a reducing agent (magnesium), the degree of extraction of neodymium into the master alloy is 99.5–99.7%. Analysis of the microstructure showed that the obtained ternary master alloy, 25Mg–50Zn–25Nd, is characterized by a uniform distribution of intermetallic compounds (Mg_3NdZn_6) in the bulk of the double magnesium–zinc eutectic. The obtained experimental data are a prerequisite for the development of industrial technology for the production of magnesium–zinc–neodymium alloys for their use in non-ferrous and ferrous metallurgy.

Roni Z. Shneck et al. [2] present detailed research on $MgTiO_3$ formed at low temperatures by the sol–gel synthesis technique. Accurate thermal expansion coefficients were measured for sol–gel products of stoichiometric $MgTiO_3$. The lattice parameters of $MgTiO_3$ made by sol–gel synthesis measured in High-temperature X-ray diffraction (HT-XRD) between 25 and 890 °C are well integrated with the previously reported HT-XRD study of sol–gel $MgTiO_3$ product between 700 and 1300 °C. The lattice parameters of stoichiometric $MgTiO_3$ sol–gel products are slightly lower than nonstoichiometric $MgTiO_3$ with maximal excess of Ti.

Songbai Xue et al. presented three articles [3–5]. These articles were related to the determination of the effects of the addition of various nanoparticles (GaF_3, ZnF_2, $Zn(BF_4)_2$ and Ga_2O_3) on the activity of CsF-RbF-AlF_3 flux and the mechanical behavior of Al/steel brazed joints. Among others, it was shown that the CsF-RbF-AlF_3 flux doped with GaF_3 obtained the maximum spreading area, both on 6061 aluminum alloy and Q235 low-carbon steel, and reached the highest shear strength of 126 MPa.

Nur Baizura Mohamed et al. [6] have studied the effect of Bi substitution on the structural and magnetic susceptibility properties of $Nd_{1-x}Bi_xMnO_3$. The XRD analysis and Rietveld refinement show the pattern corresponding to the perovskite-type $NdMnO_3$, which crystallizes in the orthorhombic system with main peak at (121) hkl plane with the Pbnm space group. The samples show a strong antiferromagnetic to paramagnetic transition existing at 76 K, 77 K and 67 K for samples (x = 0, 0.25 and 0.50), respectively. Deviation of temperature dependence of inverse susceptibility curves shows the existence of Griffiths phase in these materials.

In the next article, Natalia Kolchugina et al. [7] present research related to simulating the hysteretic characteristics of hard magnetic materials based on $Nd_2Fe_{14}B$ and $Ce_2Fe_{14}B$ intermetallics. The simulation and analysis of hysteresis loops of the quasi-ternary intermetallics $(Nd_{1-x}Ce_x)_2Fe_{14}B$ (x = 0–1) was performed. Results of the simulation indicate that the alloying of the $Nd_2Fe_{14}B$ intermetallic with Ce to x = 0.94 does not completely eliminate the negative effect of spin-reorientation phase transition on the residual magnetization of the $(Nd_{1-x}Ce_x)_2Fe_{14}B$ intermetallic and slightly decreases the slope of magnetization reversal curve.

In the next work [8], the authors develop a grid search (GS)-based extreme learning machine (ELM) and hybrid gravitational search algorithm (GSA)-based support vector regression (SVR) for estimating the maximum magnetic entropy change (MMEC) of doped manganite-based compounds. The precision of the developed models offers a green solution to the known pollutant-based refrigerants and presents ways by which manganite-based compounds of the desired maximum magnetic entropy change can be predicted for possible laboratory fabrication and implementation.

Yao Jiang et al. [9] present work related to reactively synthesized porous Ti_3SiC_2 compound and its mechanical properties with different apertures. The flexural stress–strain curves of porous Ti_3SiC_2 compounds exhibit two stages of elastic deformation and fracture, and the elastic deformation behavior shows a characteristic of kinking nonlinear elastic solid. The reduction of the pore size of porous Ti_3SiC_2 improves the phase purity, strength and stiffness while increasing its filtration accuracy.

In the last article, Qian Gao et al. [10] present an experimental study on Zn-doped Al-rich alloys for fast on-board hydrogen production. The hypothesis that Zn will change the hydrogen production performance of the alloy by entering the GB phase was verified and it was found that the reaction mechanism cannot only be explained by the eutectic reaction of the GB phase and Al.

I hope that the presented set of articles will arouse genuine interest among readers and, perhaps, encourage them to carry out their own successful research in the field of intermetallic compounds.

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