MODELLING OF MAGNETOCALORIC EFFECT IN THE GADOLINIUM-BASED ALLOYS

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The aim of the present paper was to conduct simulation of magnetocaloric effect [1] in the in the $Gd_{80}Ge_{15}Si_5$, $Gd_{75}Ge_{15}Si_5Ce_5$, $Gd_{75}Ge_{15}Si_5Pr_5$ and $Gd_{75}Ge_{15}Si_5Nd_5$ alloys using theoretical Hamad's model [2]. Based on measured temperature dependences of magnetization, collected for all samples, the theoretical M vs. T curves were calculated. An other parameters as: magnetic entropy change, full width at half maximum and relative cooling power were determined using phenomenological model. The calculations conducted in present paper showed the validity of this method in determining magnetocaloric properties either for materials manifesting the first or the second order phase transition. Theoretical predictions corresponded well with experimental results (Fig.1, Tab. 1).

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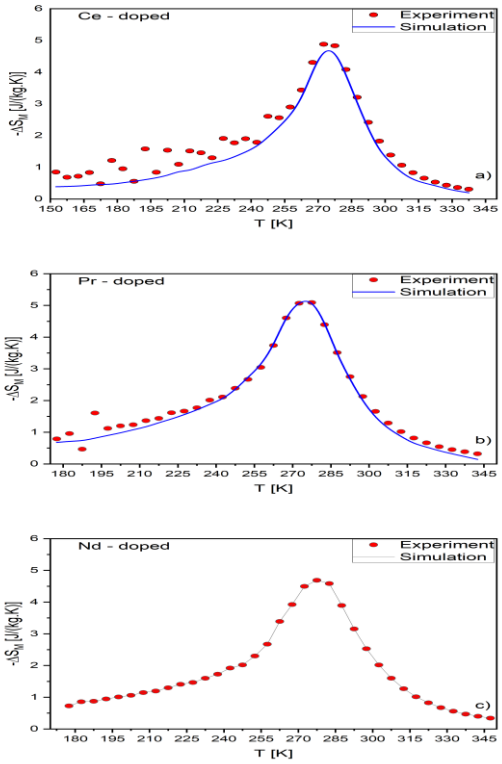

Fig. 1. Experimental and modelled temperature dependences of magnetic entropy change for all studied alloys under the change of magnetic field ~3T.

Table 1. Magnetocaloric properties as ΔS_M, δT_{FWHM} and RCP measured and modelled for all studied materials for the change of external magnetic field ~3T.

Alloy	$Gd_{75}Ge_{15}Si_5Ce_5$		$Gd_{75}Ge_{15}Si_5Pr_5$		$Gd_{75}Ge_{15}Si_5Nd_5$	
Parameter	Exp.	Sim.	Exp.	Sim.	Exp.	Sim.
$-\Delta S_M$ [J/(kg.K)]	4.88	4.67	5.09	5.14	4.69	4.68
δT_{FWHM} [K]	40	37	40	39	45	45
RCP [J/kg]	195	172	204	200	211	210

References

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