Electrical properties of $AgY_{1-x}Nd_x(WO_4)_2$ solid solutions

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Molybdates and tungstates doped with rare-earth ions (RE^{3+}) are an important group of inorganic materials that have great potential application in various fields. They are extensively studies and more often applied in such luminescent devices as diode-pumped solid-state lasers, phosphor-converted white light-emitting diodes, optical fibres, and integrated optics [1-3]. Silver and rare-earth metal tungstates, $AgRE(WO_4)_2$ (RE = Y, Ce-Lu), show polymorphism and they crystallize in two polymorphs with the monoclinic and the tetragonal symmetries [4]. The structure of low-temperature, monoclinic phases (S.G. *C2/m*) can be represented by $(W_4O_{18})^{8-}$ polyanions, and REO_8 as well as AgO_8 polyhedra. Two neighbouring REO_8 polyhedra are connected by sharing edges along the *b* axis, forming isolated RE_2O_{14} units [4]. Low-temperature modifications of $AgY_{1-x}Nd_x(WO_4)_2$ solid solutions (x = 0.005-0.20) have been successfully prepared by an annealing of stoichiometric mixtures of following tungstates: Ag_2WO_4, $Nd_2(WO_4)_3$, and $Y_2(WO_4)_3$. The mixtures of three tungstates were sintered in air at temperatures ranging from 873 K to 1073 K. The sintered ceramics were examined by XRD and SEM methods.

The electrical resistivity ρ(T) of $AgY_{1-x}Nd_x(WO_4)_2$ has been measured in the 76-400 K temperature range with the aid of the four-probe DC method using a KEITHLEY 6517B Electrometer/High Resistance Meter. The thermoelectric power S(T) was measured in the 300-600 K temperature range with the aid of a Seebeck Effect Measurement System (MMR Technologies, Inc., USA). The ρ(T) and S(T) measurements showed the insulating properties and *n*-type conduction. At high temperatures, *i.e.* above 400 K, we find a rather well defined linear slope of $S(T) = aT$ (diffusion thermopower) which extrapolates to (0, 0) [5]. The diffusion thermopower for an electron gas is due to carrier diffusion and it contains information about the Fermi edge [6]. The smaller value of the diffusion coefficient a is observed when Nd^{3+} content in $AgY_{1-x}Nd_x(WO_4)_2$ is larger. For the same samples, a reversal of thermoelectric power sign is also being observed. The residual electrical conduction of the type *n* or *p* in the solid solutions under study seem to be connected with the anionic or cationic vacancies, respectively, the same as it was observed in the $CdRE_2W_2O_{10}$ compounds [7]. The changes of sign observed in *S(T)* can be an effect of the different values of the activation energy of the vacancy acceptor and donor levels as well as a transfer of the phonon momentum to the electron gas.

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