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Poster presentations

On viscosity peculiarities of the Al-(Ni/Y) (up to 10 at. % Ni/Y)

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Recently most attention has been concentrated on the Al-based (80-90 at.%) alloys with transition and rare-earth metals used as admixtures. Increasing stability of physical-mechanical characteristics may be reached by optimizing technological regimes, i.e., temperature and exposure time of the melt. Structural-sensitive properties (in particular, viscosity) of the Al-Ni-REM system of the melts have been investigated to only a small extent. The subject of the present work is investigation of temperature, time and concentration dependences of kinematic viscosity (ν) of the Al-Ni and Al-Y binary system, with second element content being less than 10 at.%, as well as studying the polytherms and time dependences ν of the $\text{Al}_{87}\text{Ni}_8\text{Y}_5$ liquid alloy.

Temperature and time dependences of ν of the melts of the Al-Ni system are generally devoid of peculiarities, i.e., as the temperature changes the viscosity is changed, too, according to the exponential law and the equilibrium in the melts established rather quickly (5-10 min). The viscosity minimum has been observed in the concentration curve and the curves of equal overheating close to of the eutectic composition ($\sim 2,7$ at.%).

When the melts of the Al-Y system are heated nonmonotone irreversible changing of viscosity is observed. If they are further cooled hysteresis is found in the polytherms of viscosity. In case if the melts are held for a long time at high temperatures being liquid the nonmonotone changing of viscosity is also revealed. As the melt temperature increases the time of the viscosity stability (the relaxation time) decreases. Viscosity dependences, obtained for $\text{Al}_{87}\text{Ni}_8\text{Y}_5$ are of the same nature. Similar dependences for the glass-forming $\text{Al}_{86}\text{Ni}_8(\text{La/Ce})_6$, $\text{Al}_{86}\text{Ni}_6\text{Co}_2\text{Gd}_4(\text{Y/Tb})_2$ melts have already been obtained by us [1].

A quasi-eutectic structure of the melt caused by the presence of the microgroups based on the Al and the Al_3Ni compound are supposed to be revealed in the minimum of the concentration viscosity dependence of the Al-Ni system.

Taking into account a model of microinhomogeneous liquid composition the viscosity changing of the Al-Y and $\text{Al}_{87}\text{Ni}_8\text{Y}_5$ melts with time is caused by the microheterogeneous state decay which, in its turn, is determined by the presence of atomic groups based aluminides containing REM (Y).

[1] Lad'yanov V.I., Bel'tyukov A.L., Men'shikova S.G., Maslov V.V., Nosenko V.K., Mashira V.A. Viscosity of glass forming $\text{Al}_{86}\text{Ni}_8(\text{La/Ce})_6$, $\text{Al}_{86}\text{Ni}_6\text{Co}_2\text{Gd}_4(\text{Y/Tb})_2$ melts // Physics and Chemistry of Liquids. – 2008. – Vol.46. – P.71-77.