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On Viscosity Features of the Al-Ni Melts

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In recent years amorphous Al-based alloys (80-90 ат.%) with transition (TM) and rare-earth metals (REM) have increasingly attracted interest. 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 binary system, with second element content being less than 10 at.%.

Measuring the kinematic viscosity (ν) of the liquid alloys was carried out over the range of liquidus up to 1300°C by the method of damped torsional vibrations of the cylindrical crucible with the melt. All the measurements were carried out in the atmosphere of high purity helium. Cylindrical Al_2O_3 crusibles with an inner diameter of 16 mm and height of 40 mm were used. To eliminate the effect of the oxide film formed on the alloy surface, an Al_2O_3 cover was placed above the sample, which was used as a second face surface. The total mean square error in the measurement of ν does not exceed 4 % with the error in a single measurement being not higher than 2,5 %.

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 (~2,7 at.%). Also the viscosity maximum has been observed in the concentration curve close to 1,5 at.%.

Apparently, in the field of concentration up to 1,5 ат. % nickel is dissolved in liquid aluminium. A quasi-euetectic structure of the melt caused by the presence of the microgroups on the base Al and the Al_3Ni compound are supposed to be revealed in the minimum of the concentration viscosity dependence of the Al-Ni system.

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