SUMMARY

Only few data related to the values of interfacial tension arising at the boundaries of liquid alloys and slags and, at the same time, high significance of these tensions for the course of metallurgical processes, were conducive to initiating the studies aimed at the recycling processes of casted metal composite materials (MCM) based on the aluminum alloys matrix with the method of separation of the components. It is the most radical way of recycling of these materials, that consists in separation of the reinforcement material from the alloy coonstituting the composite matrix. These operations require the use of so-called recycling media, composed of melted salt mixtures of the compositions equal or approximating the ones used in conventional metallurgical operations applied to the aluminum alloys. A method was chosen for determining the interfacial tension at the boundaries between the aluminum alloys and selected mixtures of melted salts. A simple and effective stand has been designed allowing to measure these tensions. Based on ionic theory of slags a numerical index of surface properties has been developed, that provides characteristics of chemical composition of the salts used not only for purposes of MCM recycling of aluminum alloy matrices but also in metallurgical treatment of these alloys. The results of thermal analyses of melted salt mixtures served as a basis for selection of the sets of the mixtures of similar thermal properties and differentiated values of the surface property index. Direct measurements allowed to determine the values of interfacial tension at the boundaries of liquid alloy of the composite matrix and melted salt mixtures, called the recycling media. The conducted tests have shown that the values of interfacial tension in the considered systems are below earlier estimated level and, according to chemical composition of the mixtures, oscillate in the range 250÷450[mN/m]. Moreover, it was observed that the values of interfacial tension decrease in line with dropping temperature of the system. This suggests to conduct the operations (i.e. recycling, refining) in low temperature. A very clear interrelation has been found between the measured values of the tensions and the values of the indexes developed. The research shows that in order to obtain possibly low values of interfacial tension in the metallurgical (recycling) system, the composition of the salt mixtures should be distinguished by the lowest value of the developed index. Results of the research allow to assume that the index value should not exceed unity (WS≤1.0000). Low index value ensures high share of cations of large ionic radius and small ionic potential in the melted mixture. The most advantageous effect of reduction of the surface property index is exerted by potassium cations. On the contrary, among the most undesirable cations in the mixture there are aluminum cations, characterized by small ionic radius and high ionic potential. It means that reasonably selected composition of the salt mixture used in aluminum metallurgy should contain only delimited cryolite or aluminum fluoride content. Since the salt of technical purity may include various admixtures, inclusive of carriers of the cations of undesired characteristic, the manufacturers of the fluxes

designed for metallurgical treatment of aluminum alloys are advised to disclose the value of the surface property index of the preparations offered to the foundries.

Keywords: interfacial tension, melted salt, recycling