# Contribution to the aluminum - tin - zinc ternary system

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The Sn - Zn - Al alloys are one of significant candidates in the proposal of alternative lead-free solders for higher temperature soldering. Our paper deals with the study of the aluminum - tin - zinc system. Twenty Sn - Zn - Al alloys altogether with six binary Sn - Zn alloys, were prepared and studied experimentally. The specimens were studied metallographically including the micro-hardness measurements, complete chemical analysis (ICP-AES, OES), X-ray micro-analysis of alloys by EDX or WDX including SEM (BSE) in order to determine the composition and identification of individual phases. Significant temperatures and enthalpies of phase transformations were determined by DTA.

Alloys were prepared experimentally from pure Sn, Zn and Al (melting and casting into graphite mould). The alloys were further studied after casting and after long-term homogenization annealing. Cast structure with dendritic formations was apparent from the metallographical study of Al - Sn - Zn alloys. It formed due to relatively high rates of the melt cooling. Zn precipitated primarily and its volume portion decreased with increasing Sn content.

DTA analysis of all the specimens was performed on the SETARAM SYSTEM 18$^{TM}$ apparatus in high pure dynamical atmosphere of argon (¿ 6N). The analyses were carried out twice at the speed of heating as well as cooling 4 K/min. Temperatures and latent heats of corresponding phase transformations (liquidus, solidus, invariant reactions etc.) were obtained. The aluminum influences on the phase transformations temperatures. Resulting experimental data were compared with the data of known Sn - Zn binary system and Al - Sn - Zn ternary system and with the diagrams of other authors.

After long-term annealing of selected alloys in vacuum followed by quenching were carried out structural and chemical microanalyses of the present phases and their limit concentrations. The achieved results were compared with the thermodynamic modelling of the ternary Al - Sn - Zn system (computer programs THERMOCALC, MTDATA, PANDAT and database CALPHAD, COST). The diagram of the Al - Sn - Zn ternary system was given thermodynamically more precisely on the basis of our complex study [1].

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[1] KOSTIUKOVÁ, G. Nízkoteplotní slitiny pro bezolovnaté pájky, studium fyzikálně-chemických charakteristik. Disertation. VŠB – TU Ostrava, 2016, 87 p.