

**O.L. SKUIBIDA (UKRAINE, ZAPORIZHZHYA)**  
**SECONDARY ALUMINUM ALLOYS PRODUCTION AS**  
**AN ECOLOGICALLY SAFE METHOD OF INCREASING THE EFFICIENCY**  
**OF MATERIALS AND ENERGY USE**

*Zaporizhzhya National Technical University*  
69063, Zaporizhzhya, 64 Zhukovskiy St., [eskuybeda@gmail.com](mailto:eskuybeda@gmail.com)

Nowadays aluminum alloys are one of the most claiming and forward-looking material. Classic electrolytic method of aluminum production has an unfavourable influence on labor conditions and environment. Recycling of scrape and waste permits to get rid of these disadvantages, reduce electric power consumption and cut production costs. As a rule secondary aluminum alloys are the material of low quality. To increase their mechanical and service properties toxic refining-modifying fluxes are widely adopted. At the same time the use of such additions as SiC, C, Ti, TiCN, Na<sub>2</sub>CO<sub>3</sub>, SrCO<sub>3</sub> leads to increase quality of secondary aluminum alloys to the level of primary analogues.

Today's leading role of aluminum among structural materials is connected with its high corrosion resistance, electrical conductivity, high strength together with low density, ease of forming and treatment etc. The amount of aluminum output in the world is about 22 million tons per year. Aluminum alloys are widely used in transport engineering (40%), construction (20%), energy (10%) and manufacture of packaging (18%). For production of aluminum alloys as mineral as secondary raw materials are used. Electrolytic method of aluminum production from alumina provides output of high quality, but is accompanied by a number of disadvantages such as dangerous working conditions of production personnel, environmental pollution, waste accumulation and depletion of natural resources.

Nearly 2.4 ... 6 times less raw materials and 10 ... 23 times less electricity for 1 ton of secondary aluminum alloys than for 1 ton of primary ones are used. Thus, the manufacture of 1 ton of aluminum from scrap and waste replaces more than 5 tons of primary raw and auxiliary materials which are necessary for the production of 1 ton of primary aluminum. The production of 1 ton of primary aluminum requires nearly 13.000 ... 15.000 kW · h of electricity, while the production of secondary aluminum – nearly 200 ... 550 kW · h of electricity. In this regard the part of secondary aluminum alloys in metallurgy is constantly growing. Reuse of waste products expands resource base, saves nonrenewable sources of raw materials, prevents pollution, achieves a significant economic benefit by saving the current expenses and investments. Recycling delivers from the necessity of regeneration of mining areas and ore concentration, land reclamation and utilization of wastes of mining and processing enterprises.

The U.S.A., Japan, Germany, France, Britain and Italy are the leaders of recycling in the aluminum alloys production. The European Union currently produces about 5.1 million tons of primary aluminum and 5.2 million tons of secondary aluminum per year. World production of aluminum from scrap and waste is about 10 million tons per year. One of the main consumers of recycled aluminum is automobile industry. The presence of aluminum in all kinds of transport provides increase of speed, safety and energy savings. For example, nearly 63% of aluminum for automobile production in the U.S.A. is a secondary metal.

The development of industrial production demands increasing requirements to the quality of castings, so a simple remelting of secondary materials is not enough effective. The main problem of secondary aluminum alloys production is their relatively poor quality. In many countries such level of recycling is achieved that the alloys are similar in quality to primary analogues. However, the technologies that are used need to be improved in terms of labor safety and environment protection. The use of hazardous and noxious substances such as KBF<sub>4</sub>, KCl, NaF, NaCl, KCl, Na<sub>3</sub>AlF<sub>6</sub>, C<sub>2</sub>Cl<sub>6</sub>, BaCl<sub>2</sub> and AlF<sub>3</sub> is generally accepted. But comparatively identical results can be achieved with the help of ultrafine powder-based refining-modifying fluxes. According to our researches the use of SiC, C, Ti, TiCN, Na<sub>2</sub>CO<sub>3</sub>, SrCO<sub>3</sub> promotes considerable increase of mechanical and service properties of secondary aluminum alloys. The level of hardness, tensile strength and plasticity of the alloys AK5M2, AK6M2, AK8M3 and AK9M2 met the requirements of ДСТУ 2839-94 (ГОСТ 1583-93) and didn't give up to primary analogues. So the problem of aluminum alloys production can be successfully solved by modern resource- and energy-saving environmentally safe technologies.