Operational risk assessment of failure to obtain the properties of thermal treatment of air aluminum alloys

Stanislaw Nowak[1], Boguslaw Swiatek[2], Krzysztof Zaba[1], Adam Sury[3], Marek Wojtas[4], Marcin Głodzik[1], Daniel Pociecha[1], Sandra Puchlerska[1]

[1] AGH University of Science and Technology, Mickiewicza 30 Ave., 30-059 Cracow,
krzyzaba@agh.edu.pl
[2] AGH University of Science and Technology, Mickiewicza 30 Ave., 30-059 Cracow,
boswiate@agh.edu.pl
[3] INFOSTER Sp. z o.o., ul. Gorna 5a, 30-094 Krakow
[4]ELSTA Sp. z o.o., ul. Janinska 32, 32-020 Wieliczka

Key Words: *aluminum, variability problems, neural networks*

The paper presents an analysis of one of the fundamental problems of special heat treatment process supervision of coatings and aviation elements as structures made of aluminum alloys. These are 2xxx, 6xxx, 7xxx series alloys. The process is carried out in four stages (heating to a high temperature to supersaturate, properly rapid cooling, storage at a low temperature and aging at elevated temperature). In addition, are carried out forming processes or the plastic forming after supersaturation or after aging.

The problem is to assess and predict the risk of failure to obtain the required mechanical properties and other physical characteristics of the process variability and the result of their own extraordinary - emergency reasons. For this purpose were built volatility models used by the expert system of monitoring and improvement processes.

As part of the solution to the problem were built three models.

1. Model of statistical variation, assuming that it is known the value of the system response to individual changes in individual parameters. It was determined based on the results of the various dependencies.

2. Model described by neural networks constructed on the basis of experimental results.

3. Model approximated by polynomials - the method of least squares.

Models are constantly being improved thanks to the harvested data acquisition module process.