STORAGE OF NON-ALLOY STEEL FLUX-CORED WELDING WIRES IN SIMULATED CONDITIONS

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INTRODUCTION

The market share of the Flux Cored Arc Welding (FCAW) process in many branches of industry is still growing. One of the major limitations of the method is the sensitivity of flux-cored wires to environmental conditions during storage and transport. Manufacturers indicate the ranges of temperature and relative humidity in which wires should be stored, but in real conditions it happens that these conditions cannot be maintained.

The aim of the study was to to verify the influence of simulated temperature and relative humidity on non-alloy steel flux-cored wires.

MATERIALS AND METHODS

A series of tests of 16 types of wires with rutile and metallic cores was carried out. The wires were stored for 48 hours in a climate chamber in 4 climatic variants which have been chosen to represent different climatic zones.

Relative humidity \ Temperature	40°C	10°C
40%	Dry-hot conditions	Dry-cold conditions
80%	Wet-hot conditions	Wet-cold conditions

RESULTS

Before storage, all wires had a smooth and clean surface. Microscopic observations confirmed the diversified structure of the wires - in the initial state, they differed significantly in seam closure, smoothness of the edges, presence and tightness of a copper layer, presence of scratches on the surface. After storage degradation symptoms were found: corrosion centers of varying intensity, matting of the surface, deepening of surface scratches. The worst, wet-hot conditions most often caused large changes on the surface of the wires, both copper and non-copper plated, seamless and with a seam.

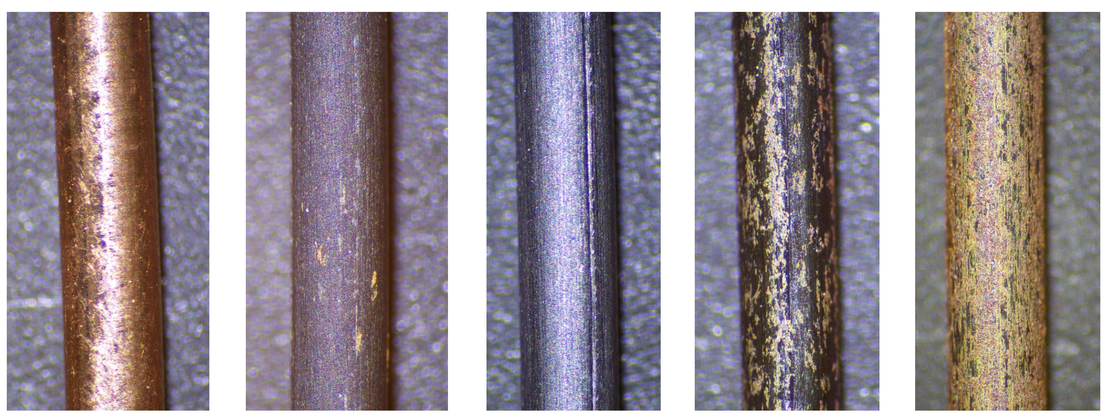

Fig. 1. The surface of the wires after 48 hours of storage

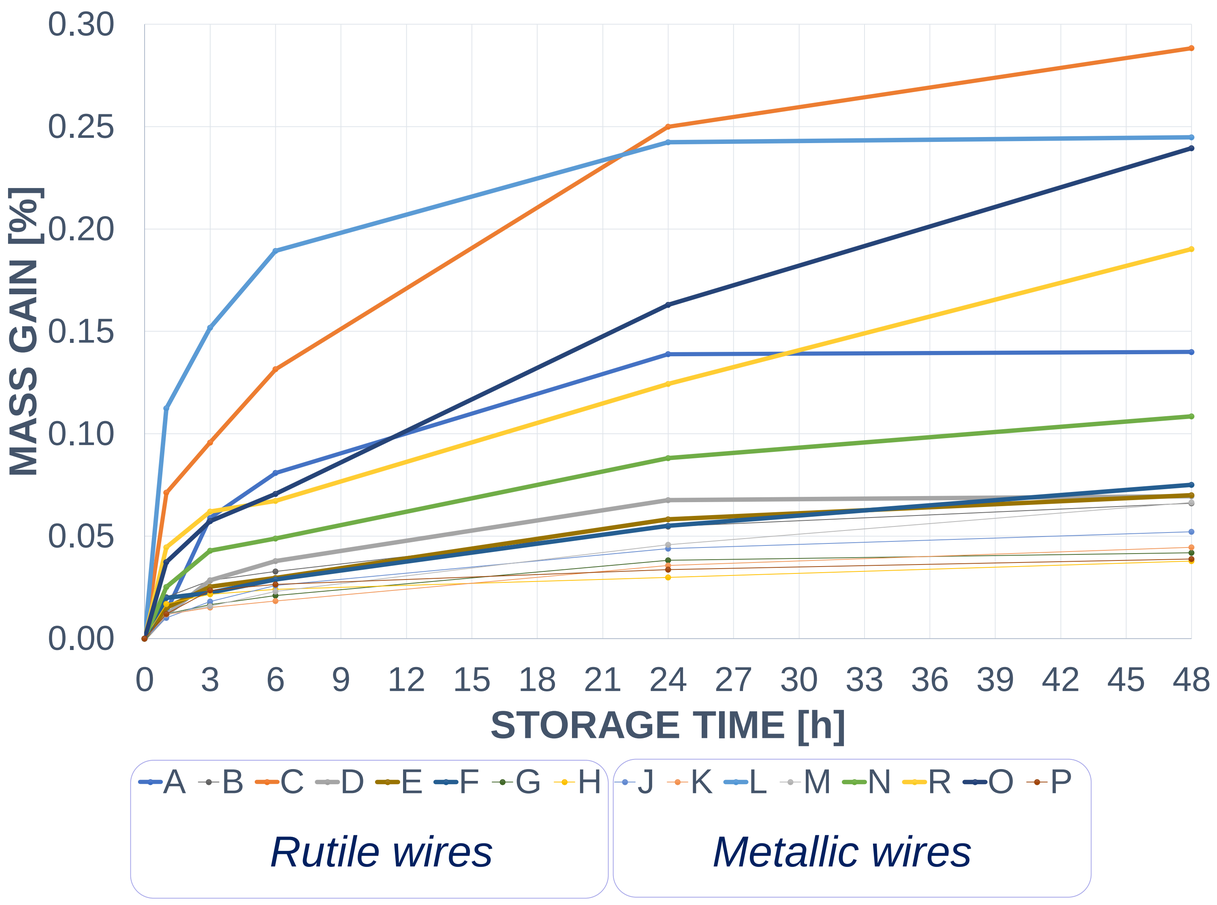

Fig. 2. Mass gain of wires during storage in wet-hot conditions

Periodic measurements of the weights of the wires indicated that dry-hot and dry-cold conditions are favorable for all tested grades - they most often showed no changes in mass, and in some cases even drying compared to the initial state. However, wet conditions significantly moisturized the wires. In the case of higher temperature, most of the wires gained about 0.05% of mass, but there were grades that after 48 hours gained almost 0.3% of mass and still did not reach saturation. The wires most susceptible to water absorption included both rutile and metallic grades. Lowering the temperature reduced the intensity of this phenomenon several times.

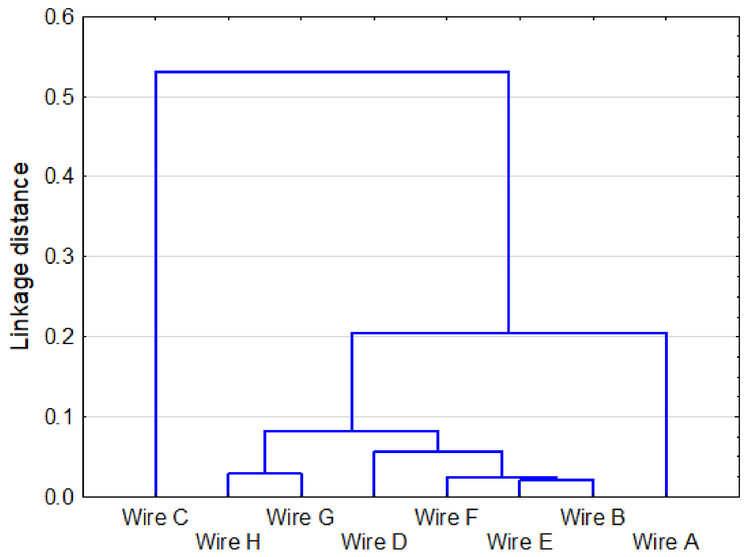

Fig. 3. Dendrogram of rutile wires stored in all tested conditions

CONCLUSIONS

1. Storage conditions simulating different climatic zones strongly influence the quality of flux-cored wires. The greatest degradation occurred in wet-hot conditions: relative humidity 80% and temperature 40°C.
2. The wire filling (rutile or metallic) has a lower impact on the degradation of the wire and its water absorption during storage than the manufacturing process, which determines the state of the seam and the surface.
3. Cluster analysis allowed to rank different grades of flux-cored wires in terms of their resistance to various storage conditions.