

Keynote Lectures

KL01

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Biomimetic Methods and AI Technics Assisting Heat Treatment Processes Nitriding and Nitrocarburizing; an Interwoven Braid of Science and Innovation

Heat treatment is widely used in high value added technologies from a simple immersion quenching of gears up to the complex production technology of press hardening. The selection of process parameters to develop the desired properties is challenging due to the complexity of the physical phenomena occurring during the manufacturing cycle.

In the last decade several computational methods have been applied successfully to optimize the heat treatment processes. Among others, Biomimetic methods have been developed for solving complex and robust optimization problems on the field of casting, metal forming and heat treatment operations. These numerical methods are based on the emulation of the models, systems, and elements of nature for the purpose of solving complex human problems. These models have been inspired by structures and behavior of living creatures.

The development of computer modeling and simulation tools have led to great advances in understanding how materials behave during Heat Treatment operations. Unfortunately, high-fidelity computational simulations can take significant time to run and require large computational capacity. Process optimization requiring many simulations at different conditions can be expensive. To mitigate these obstacles to widespread use of sophisticated computer models, Artificial Intelligence methods based on neural networks could be support the Heat Treatment processes.

This paper is focusing on the state of the art of computational technics including Biomimetic methods and Artificial Intelligence approaches used to support Heat Treating Operations.