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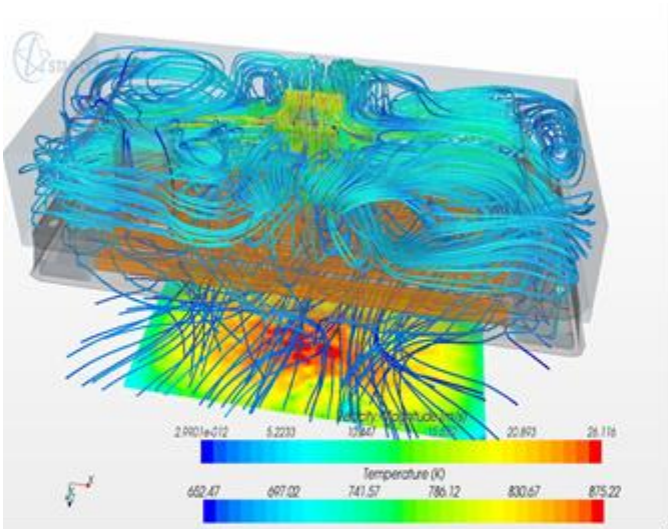
Numerical analysis of IR heat transfer processes – accuracy through simulation

In the modern process development methodology, Numerical simulation (Computer-aided Engineering - CAE) has become a key enabling factor in the virtual analysis and optimization of highly competitive and advanced systems. Applied from the concept definition until production release, already experimentally approved CAE methods have been driven forwards in the last years as a powerful tool for aiming a clear strategy: decreasing costs and duration of development processes. Furthermore a rise in quality, flexibility and innovation is seen as a strategic goal of CAE.

CAE instead of "trial and error"

Complementary to traditional "trial and error" methods, CAE tools based on ray tracing or finite element analysis are now extensively used to achieve a better understanding of heat processes like wafer cleaning, paint/lacquer drying or plastics welding and to predict solutions for several technical failures. The expensive "Thermal Process" laboratory verification tests are assisted or even replaced by more efficient and advanced computational methods.

CAE tools are being widely used to investigate temperature distribution in substrates with complicated structures, to analyze the robustness and performance of components and assemblies from the thermal management perspective. Furthermore CAE can predict and visualize accurately the fluid flow pattern within systems with cooling devices like blowers and fans and the influence of temperature gradients or pressure drops or flow's behavior. Through accurate physical analysis of two coupled mechanisms: fluid dynamic and heat transfer in terms of irradiation, convection and heat transfer, CAE became major provider of information to support design teams in interactive optimization and decision making. It contains large computational capabilities to localize potential source of quality fluctuations and to quantify the impact of such no-uniformities on process and product integrity. It facilitates in-line optimization of industrial processes with heat applications from the perspective of energy consumption and potential energy savings.



Features

Classical requests from customers:

- Homogeneous temperature (heat) distribution
- Optimal cooling
- Analysis of material properties upon IR heating
- Energy efficiency

Tools:

- Ray-Tracing
- Computational Fluid Dynamics (CFD)
- Multiphysics Modeling (FEM)
- Monte-Carlo radiative transfer modeling

All models are developed and analyzed using correct and realistic boundary conditions.

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