AIRFLOW SCIENCES CORPORATION

The Airflow Update®

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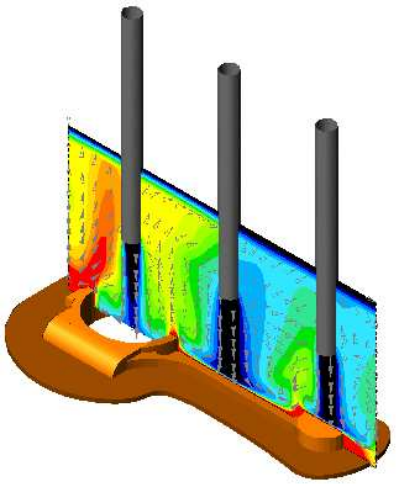
Controlled Cooling of Forged Parts

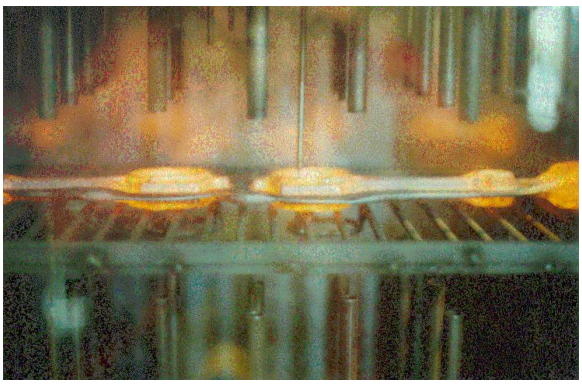
Many hot-forged parts are subsequently heat treated to achieve the desired material properties. The desired material hardness and microstructure can often be obtained directly from the forge temperature if the parts are cooled in a controlled manner. Elimination of the secondary heat treating operation can result in a significant energy and cost savings and can streamline the manufacturing procedure.

ASC's testing and simulation services can be an integral part of the development of a controlled cooling process.

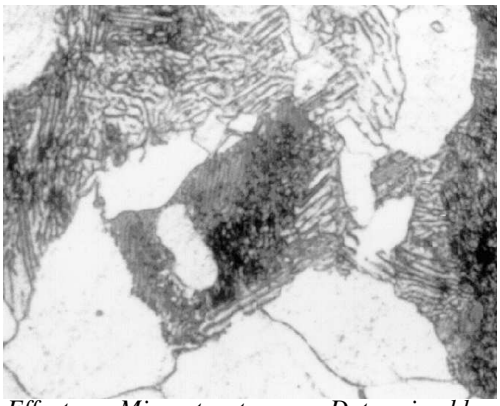
In addition to the connecting rod example shown, ASC developed a controlled cooling enclosure for hot-forged crankshafts for Ford Motor Company. The goals of that study were to achieve the desired material properties, shorten the overall cooling time, and operate the entire system on the thermal energy of the hot forgings. The enclosure was built to our specifications, and all of the design goals were met.



CFD Evaluation of Impingement Cooling/Quenching Method



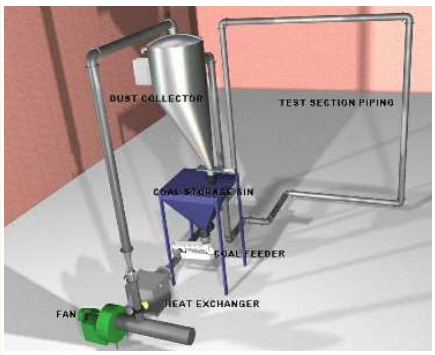
Test of Impingement Cooling/Quenching Method



Effects on Microstructure are Determined by ASC's Experienced Metallurgical Partners

Airflow Sciences was recently awarded an exciting R&D project with the Electric Power Research Institute (EPRI). ASC will design and oversee construction of the EPRI Coal Flow Measurement and Control Laboratory. This high-tech research facility will be used to explore ways to optimize the combustion of pulverized coal in electric power plants.

Depicted at right, the lab will feature a closed-circuit, full-scale coal pipe along with a fan, coal feeder, and dust collector. Pulverized coal will be circulated through the pipe to evaluate various extractive and on-line air and coal flow measurement instruments. The facility will be located in Michigan and is scheduled to be up and running in early 2003.



From the Editor

ASC's web site provides a wealth of information on solutions to engineering and fluid dynamic problems. There, you can download copies of our recent talks, seminars, and presentations. New additions include our seminar on "ESP Flow Fundamentals", which was presented at ESP/Fabric Filter Roundtable last August and our poster presentation from Biophex (Oct 2002). Stay tuned for our flow modeling technical paper, which Rob Mudry, P.E. is presenting at Power-Gen this December.

News on the home front: ASC would like to extend a whole-hearted welcome to our new team members. Jeremy Davis has joined our laboratory staff, Kevin Dugdale is heading up our European Region Office in the UK, Paul Harris, Ph.D., has returned to ASC after a two-year interlude in Ukraine, and Craig Rood has accepted a position after receiving his M.S.E. in Aerospace Engineering.

If you have any flow, heat transfer, mixing, combustion, or mass transfer issues you're dealing with, feel free to give us a call at (734) 525-0300.

Edited by Kevin Linfield

Optimizing Boiler Combustion Using Flow Models

The overall performance of a power plant depends significantly on how fuel and combustion air enter the furnace. Large fossil fuel boilers can have up to 100 individual burners that inject fuel and air. The proportion of flow through each of these plays an important role in the efficiency of the combustion process. By properly designing the combustion system, plant emissions of NOx and CO can be minimized while boiler efficiency and equipment longevity are maximized.

Often the engineering design process for a combustion system involves a flow model of the air and/or fuel delivery equipment. The figures show two different types of models used for the design of a power plant windbox (the duct that feeds combustion air to the burners).

Figure 1 depicts a 1/18th scale physical model of an actual windbox. A fan supplies air to the model, and laboratory experiments are performed to analyze the velocity, pressure, flow rate, and other fluid dynamic properties. These models are usually built with clear materials to allow for smoke flow visualization.

Results from a computational fluid dynamics (CFD) windbox model are shown in Figure 2. In a CFD model, the geometry is represented virtually using a computer. Sophisticated software calculates the air flow properties including velocity patterns, pressures, flow balance, temperatures, etc.

For this windbox, flow modeling allowed deficiencies in the basic design to be pinpointed. Design of flow control devices such as turning vanes and baffle plates were optimized using the model before any actual construction occurred at the plant. The final design from the model was implemented to achieve optimal combustion of a low-NOx burner system.

After implementing ASC's windbox design changes to balance secondary air, Deseret G&T's Bonanza plant Unit 1 realized an 8% decrease in NOx, a 40% reduction in unburned carbon, and a net heat rate improvement of 0.7%.

Figure 1: Physical Model

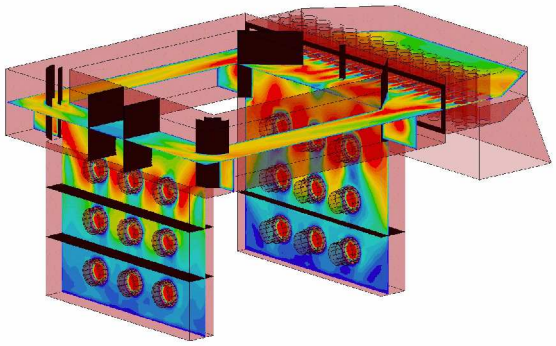


Figure 2: CFD Model

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Airflow Events

We've recently participated at the IFT Food Expo, ASM Material Solutions and Surface Engineering Exposition, Biophex, and ESP/ Fabric Filter Roundtable.

We hope to see you at future trade shows including:

-Power-Gen 2002 (Dec 10-12, Orlando, FL).

- NOx User's Group (Jan 28-30, Birmingham, AL)

- Electric Power (March 4-6, Houston, TX)

In the meantime, if you are facing flow, heat transfer, or mass transfer issues, please give us a call.

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