NASF SURFACE TECHNOLOGY WHITE PAPERS
81 (9), 1-2 (June 2017)

Production Schedule Driven Automated Energy Management

by
*Andreas Schuhmacher and Robert Freund**
Aucos AG
Aachen, Germany

Editor's Note: Editor's Note: This paper is a peer-reviewed and edited version of a presentation delivered at NASF SUR/FIN 2016 in Las Vegas, Nevada on June 6, 2016.

ABSTRACT

Surface finishing line process automation systems are normally designed to optimize production throughput and assure compliance with operating parameters such as time-in-tank. Depending on the production mix, hoist automation can utilize fixed timeways, fixed-mixed (optimized) timeways, or fully dynamic scheduling. When energy management is an added constraint, process models must be revised to manage the new constraints while still assuring required throughput and product quality. The basic elements of automated energy management on process lines are control of energy consumption in active, standby and inactive states, primarily by ventilation, heating and cooling, agitation and filtration. The automation system evaluates the production schedule to cycle equipment through these states as required to optimize the three high level requirements of the process line: throughput, quality and energy management. This paper presents a case study of the new process control model.

Modern controls are no longer limited to hoist scheduling and rectifier control, but integrate all of the functions in a surface treatment line. This includes basic controls like transports, heating, cooling, etc., but also control of chemical processes and production scheduling, often with a direct connection to a factory ERP system. Based on all of these functions and data, controls are able to help maximize energy efficiency.

Surface treatment and plating lines require a great deal of energy. The largest consumers are transports, ventilation, process solution heating, process cooling, agitation, filtration, drying and electrolysis. Some of the energy consumption is directly linked to parts produced, like transports and electrolysis. Other energy is consumed just to make process solutions available for processing.

While in high production lines most process solutions are utilized almost all of the time, there are other plating and surface treatment systems that offer a very high variety of processes and finishes which can be used in a very flexible manner, but are needed for only a limited capacity.

In these cases where only part of the process capacity is needed at a time, controls are able to help save energy. There are two ways by which this is achieved:

*Corresponding author:
Dr. Robert Freund
Chemist
Chairman of the Advisory Board
Aucos AG
Aachen, Germany HRB 20037
Phone: +49 212 819860
Cell: +49 172 249 7027
E-mail: robert.freund@aucos.de

1. Energy savings by activating process solutions only when needed per production schedule.

Process solutions, dryers, etc., are assigned either "inactive" or "standby" or status "active" as needed for processing. Energy management by controls makes sure that energy consumers like heating, cooling, ventilation, etc., are switched from "inactive" or "standby" into status "active" only when there is a production need.

Process solutions also have to be ready on time, without delaying production. With heat-up times of several hours required to heat wet solution tanks, heating has to be started early enough, based on the planned production schedule. If there is a need for production with short notice, a "standby" temperature needs to be set, taking the required heat-up times into consideration.

2. Energy savings by line design

When a surface treatment system is laid out for multiple processes, yet only few of these will be utilized at a time, it is possible to limit total energy consumption to the production rate as needed.

Ventilation as an example:

Instead of installing a ventilation system for using all process tanks at same time, a much smaller system is sufficient. For a large multiple process surface treatment system, this technology allows significant energy savings.

Ventilation reduction can be achieved by using covers and dampers on all tanks that need ventilation. Closed covers may reduce ventilation rate down to about 10% of rate needed without covers.

For tank-to-tank transfers, covers are opened and closed automatically. The maximum energy consumption then depends on the number of covers which are opened at the same time.

Controls regulate an important function:

Software for automated energy management will limit the number of open covers at one time and assure that there will be no situation where more energy is needed than the capacity installed.

In addition to the usual control software packages, there is production schedule driven automated energy management needed as well. This has an influence on the maximum production capacity of system. As an important tool in the design phase of a surface treatment system, simulation of future system production can identify bottlenecks and verify capacity.

About the authors:

Andreas Schuhmacher is CEO of AUCOS AG, Aachen, Germany. Andreas attended RWTH Aachen University and graduated as Diplom-Ingenieur of electrical engineering. He has been with AUCOS since he left university. Doing technical developments for controls and for single part plating technologies, he soon took over responsibility for projects and sales. Andreas developed the Asian market for AUCOS, setting up service and sales offices in China and in India. He has been the CEO of AUCOS AG since 2014.

Dr. Robert Freund is Chairman of the Supervisory Board of Aucos AG. Robert holds a Ph.D. in Chemistry, from the University of Cologne. Using methods of chemical science together with experiences he collected in a small family owned plating shop, he developed special plating control technologies. Robert is one of the founders of AUCOS AG and has run the business from 1979 to 2014, entering the USA market in 1985. Robert is member of the German Association of Plating and Surface Technology and has been member of the board of the association from 2008 to 2014.