



Low-Temperature Colossal Supersaturation (LTCSS) of Stainless Steels

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Abstract

Low-temperature colossal supersaturation (LTCSS) is a novel diffusional surface hardening process for carburization of austenitic stainless steels and other alloys without the precipitation of carbides. The formation of carbides is kinetically suppressed, enabling extremely high or colossal carbon supersaturation. As a result, surface carbon concentrations in excess of 12 at.% are routinely achieved. This treatment increases the surface hardness by a factor of four to five, improving resistance to wear, corrosion, and fatigue, with significant retained ductility.

Swagelok won the 2006 Engineering Materials Achievement Award for its development and commercialization of this breakthrough technology. At present, Swagelok uses the technology for treatment of tube fitting rear ferrules, mostly manufactured in type 316 stainless steel. Swagelok is commercializing LTCSS as SAT 12sm, and formed the Swagelok Technology Services Company in 2007 to direct these efforts.

LTCSS provides a uniform and conformal hardened gradient surface with no risk of delamination or peeling. The hardness layer is at least 25 μ m thick, with a near surface hardness of \approx HV1200 (over 70 HRC). The thickness of the hardened layer can be increased further by additional carburization treatments. Hardness depths of 10 μ m to 50 μ m have been routinely achieved. The treatment retains the austenitic phase and is completely non-magnetic. In addition, because parts are treated at low temperature, they do not distort or change dimensions. In addition to austenitic stainless steels, research efforts are underway to extend the technology to other industrially important alloys, such as precipitation-hardening stainless steels, duplex alloys, nickel-based alloys, and cobalt-based alloys.

This talk will describe the LTCSS technology, and will discuss research findings from a recent Department of Energy project that quantified the performance improvements for treated materials.

Biography

As senior research fellow at Swagelok Company, Sunniva R. Collins is responsible for coordinating the company's academic and governmental research partnerships. She joined Swagelok in 1995 as a research metallurgist and has served in engineering management positions including manager, standards and product regulatory compliance. Most recently, Collins acted as the technical director of Swagelok Technology Services Company, a wholly owned subsidiary of Swagelok Company.

Collins received her doctorate and master's degree in materials science and engineering from Case Western Reserve University and her bachelor's degree from the University of Michigan. She was Swagelok's Principal Investigator on a three-year DoE-funded project to evaluate low temperature colossal supersaturation (LTCSS, now being commercialized by Swagelok as the SAT 12 process) , which completed at the end of 2006. On this project, she was responsible for program management of collaborative research with Case Western Reserve University (CWRU), Oak Ridge National Laboratory (ORNL) and other industry partners. The results of this research have been recognized with the 2006 ASM Engineered Materials Achievement Award, and a 2008 R&D 100 Award.

Dr. Collins has worked to develop key standards on welding, surface finish requirements, and corrosion test methods for the semiconductor equipment industry. She has also instructed courses for ASME on Bioprocessing Equipment (BPE) and for the International Society of Pharmaceutical Engineers (ISPE). Collins is a Fellow of ASM International (FASM) and is currently serving on the ASM Board of Trustees. She was the Cleveland Chapter Chair from 2000 to 2001. She is listed in *Who's Who in America*, *Who's Who in Science and Engineering*, and *Who's Who in American Women*.

Location:

La Mirage
3223 Algonquine Rd.
Rolling Meadows, IL 60008
Phone: (847) 222-1222

Tentative Schedule:

4:30-5:30 pm Executive Committee Meeting
5:30-6:30 pm Hospitality Hour
6:00-6:30 pm How to Network
6:30-7:30 pm Dinner Followed by Presentation

Directions:

Please visit La Mirage's website:

<http://www.lamiragechicago.com/Location.html>

***** RSVP by Friday, Feb. 5th, 2010 *****

Pre-registration by Friday prior to meeting: \$25. Registration at door: \$35

Pre-registration for Students: Free. Registration at door for Students: \$5

To make your reservation, please go to <http://www.chicagoasm.org/>