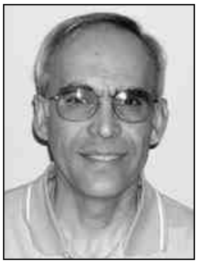

Finishers' Think Tank

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Replacing Chlorinated Solvents with Aqueous Based Cleaning Processes III: Ultrasonic & Mechanical Cleaning

Last month's column focused on aqueous cleaning considerations. This month we highlight points with regards to ultrasonic and mechanical cleaning. Each, in its own operation, makes use of induced energy, to energize the dynamics of soil removal. These processes have been proven to be effective and efficient for many decades. Sometimes it is good to refresh the information and dynamics of these cleaning systems, which have experienced continual improvements and refinements. Properly using the tools at our disposal can be very helpful when or if there is a need to consider replacing chlorinated solvent cleaning.

Ultrasonic cleaning

This process takes the concept of soak cleaning, adding to it the use of high frequency sound or ultrasonic waves. A combination of chemistry and this form of energy will effectively remove a multitude of soils. There is a wide range of soils that should be identified. These are: oils, grease, buffing and polishing compounds, paraffins and waxes, abrasives, rouges, metallic chips, fragments and shavings. Ultrasonic cleaning especially lends itself to removing these soils that are mechanically embedded in recessed areas. Common critical cleaning sites of this type include lettering, designs and inner diameters of tubing,

At the heart of this technology is an ultrasonic generator. It produces ultrasonic energy, coupled with a transducer unit, changing the signal to mechanical energy. This in turn produces a favorable cavitation action, scrubbing parts clean. The transducers employed are normally 20 kHz, but for specialized applications, 40 to 100 kHz can also be used. In the working solution, the cavitation intensity increases as the temperature of the cleaning solution increases. This usually holds up to a solution temperature of 160°F (71°C). Beyond this temperature range cavitation steadily decreases.

It is important to rack or fixture parts carefully . This will maximize exposure to sufficient levels of ultrasonic energy that in turn enhances the effectiveness of the cleaner chemistry. Consequently there is an optimal alignment of the transducer with respect to the parts. Routine maintenance of the transducer is important to maintain optimum performance. Design and fixturing of parts should promote good solution drainage, prevent air entrapment and allow for favorable penetration of ultrasonic energy.

Ultrasonic cleaning solutions usually provide formulations in the pH range of 8-13. Appropriate selection of the cleaner formulation is made to be compatible with the substrate to be cleaned. The cleaning of non-ferrous or more sensitive metals may also include inhibitors in the cleaner concentrate. Such metals that are commonly ultrasonically cleaned include: aluminum, brass, white metal and zinc. The ultrasonic cleaner may be the first step in surface preparation, or it may precede a soak cleaner. If simply cleaning the parts is the only requirement, then drying will be essential. Mechanical dryers such as spin units, hot air knives or centrifugal types are commonly used. Most ultrasonic cleaning formulations impart a protective film over the basis metal. This film residue is typically from poor rinsing. It is a condition noted as water breaks on the just cleaned parts. Such a condition is critical if the parts are to be plated, painted or subject to some additional surface finishing treatments. A soak cleaner dip is usually sufficient to remove this film, followed by proper drying. In a plating cycle, the soak cleaner may be followed by or substituted with an electrocleaner, to remove the inhibitor film. Now the parts are free rinsing, clean and ready for surface activation before plating. It is also important that the correct electrocleaner is used, thereby avoiding tarnish, etching or pitting of the surface.

Mechanical cleaning

This is a proven cleaning method, in use for rapid, effective removal of soils. It can be used for bulk, large volumes of parts. Cleaning is very effective in automated equipment. Painting, powder coating and phosphate lines make heavy use of mechanical cleaning. It is conducive to bulk cleaning of stamped and mechanical parts. Mechanical cleaning combines chemical and mechanical energy to remove soils. The lower temperature requirement in a range of 120-150°F (49-66°C), reduces power costs for heating. This is a big cost savings with respect to lowering energy demands. In addition, consumption of the mechanical cleaner may also provide welcome cost savings. Spray and other appropriate forms of agitation during the cleaning cycle provide mechanical force, significantly improving the removal of soils. As such, the cleaner blends are low foaming, blended with powerful solvents (SARA Title III exempt types), dispersants and water conditioners (to prevent spray nozzle plugging). Based on the types of metals to be cleaned, the pH of a cleaner may range from near neutral to 14. Cleaner blends are available for all sensitive metals, both non-ferrous and ferrous types.

The desired mechanical action is critical to cleaning success. In spray cleaning, the pressure (PSI) of application is important for coverage of parts and improving the ability to dislodge soils. In wash machines, agitation trays or baskets of parts are placed in sealed compartments. Up / down, rotational, side-to-side action occurs. Racking of parts or placement in bulk tubs should be considered in parts configuration or design. This should incorporate accessibility to proper drainage of solutions and rinsing. Mechanical cleaners predominantly employ displacement of soils. Practical equipment advantages include recirculation tanks that can be continually skimmed to remove soils. Cost savings are realized by extending the cleaner bath service life and simplifying waste treatment.

Equipment considerations

New mechanical cleaning lines or stations can be readily put in place. Design and space allocation can be determined as per most cleaning processes. Used equipment, in good operation, can provide welcome cost savings. The overall capital expenditure can contribute to end-of-year business tax benefits. Typical criteria to consider include the basics of what is needed for the specific requirement, and converting to an aqueous cleaning operation. Heating can be electric immersion, insulating hot water, steam or gas-fired. Dryers can be centrifugal or forced air. Mechanical washers may include single station spray cabinets, multi-station (three or five stage) and automated, rotating, sealed washers. Other considerations include energy sources to power equipment, work areas, plumbing, remodeling and expanding existing floor space. *P&SF*

In Memoriam

Edward P. Durkin

With sadness, the Ohio Association of Metal Finishers (OAMF) has informed us that Edward Durkin passed away suddenly at the age of 77 on December 1, 2009. Over his career, Edward was very active in Association activities on the local and national levels.

He graduated from St. Ignatius High School in 1950 and went on to receive a B.S. in Chemical Engineering from the University of Detroit. He was a Veteran of the U.S. Air Force, where he served as a pilot for three years. He was President of The Advance Plating Co. and Plastic Platers Inc., of Cleveland. He was President of The National Association of Metal Finishers in 1974-75. He was also a Past Board Member of St. Ignatius High School and advisor to St. Joseph Academy, Magnificat High School and the Ursuline Sisters.

Edward was the beloved husband, of 50 years, to Barbara (née McEntee) and father of Beth, Kevin (Ann), baby Mary (deceased), Sr. Susan and Patricia Schroer (Andrew). He was blessed with five grandchildren, Patrick, Brendan, Kevin (deceased) and Mary Kate Durkin and Jack Schroer. He was the Son of Edward F. and Helen (née McFadden) (both deceased) and the brother of Helen McAuley (deceased), Dorothy Egan (Donald), George (deceased) (Mary Lou), Jack (deceased), Therese Lustic (Gary) and Thomas.

Thomas W. Kohler

Tom Kohler, of Fayetteville, NY and a long-time AESF Syracuse Branch member and retired Enthone sales engineer, passed way at the age of 93 on November 16, 2009. He passed away peacefully surrounded by his family at Francis House, in Syracuse. Born in Little Falls, he graduated from Little Falls High School in 1936 and St. Lawrence University in 1940. He retired in 1985 from Enthone, Inc. In addition to the AESF, he was a member of the Disabled American Veterans and the Boy Scouts. He served in the Army during WWII as 1st Sergeant in the 59th Field Hospital. His wife, Joan Huebler Kohler died in 1993. He is survived by three daughters, Mary (Jim) Sanderson of Brighton, CO, Margaret (Bill) Gruetzmacher of Plattsburgh, NY and Elizabeth Kohler of Fayetteville; his son, William (Kate) Kohler of Manlius, NY; his sister, Margaret Kohler of East Syracuse, NY and eight grandchildren, Tom, Dawn, Zeke, Libby, Casey, Max, Liam and Emma.

Tom was truly a pioneer and all around super guy. Throughout his career Tom's customers, colleagues and competitors alike loved him almost as much as he loved the surface finishing industry.