Hazardous Waste Reduction from Chemical Etching of Titanium Alloy Turbine Blades

Client
TECT Power manufactures critical titanium rotating components of turbine engines for aviation and industrial applications, as well as components for other industries with similar engineering and quality requirements. NYSP2I worked closely with Mohawk Valley Applied Technology Corporation, the Regional Technology Development Center in the Utica area.

Opportunity Areas
In 2007, TECT generated 502 tons of hazardous acid waste from its titanium etching operations and spent over $395,000 on acid disposal, purchase of new acid, and generator fees. These expenses are expected to rise as acid prices and hazardous waste disposal costs increase. TECT requested assistance from NYSP2I to reduce the amount of acid waste from their manufacturing process.

Objectives
It was critical to determine what operational changes could reduce the acid waste generated without adversely affecting the process, and implement these process improvements.

Work Performed
A literature search identified two critical articles that provided details of the chemistry of titanium etching in a nitric/hydrofluoric acid mixture used at TECT. This led to a proposal to change the existing acid boost method in the etch baths to extend the acid bath life beyond one week (normal condition). A test protocol was developed and approved by TECT and implemented in a selected etch tank. TECT was also assisted in evaluating a vendor-supplied analyzer that would determine acid concentrations more accurately and reliably than the analytical method currently utilized, thereby allowing greater precision in determining acid boost additions.

Results
Actual reductions in hazardous waste from chemical etching operations amounted to 186 tons per year in 2009 when compared to 2007, the year NYSP2I began working with TECT. This 47% reduction represents savings of $83,500 per year, and reflects implemented P2 process improvements while accounting for decreased production. If TECT fully implements NYSP2I’s recommendations for all of 2010, hazardous waste from chemical etching operations can be potentially reduced by 340 tons (86%) at a savings of $197,000 if production volumes remain at 2009 levels. If NYSP2I had fully implemented NYSP2I’s recommendations in 2007 (the baseline year), then hazardous waste from chemical etching operations would have been reduced by 431 tons (86%) at a savings of $290,000.