

SOLUTIONS FOR COST-EFFECTIVE SLURRY REPROCESSING IN CHINA'S SOLAR WAFER MANUFACTURING MARKET



Strict quality control measures are integral to CRS' proprietary design for slurry reprocessing.

PES DISCUSSION WITH SCOTT RADEKER (VICE PRESIDENT & GENERAL MANAGER – ASIA AND EUROPE, LOUISVILLE, USA) ON COMPANY VISION FOR EFFECTIVE REPROCESSING.

Beginning in about 2010 and continuing into 2014, the solar market in China has undergone a distinct phase shift in cost structure. This transformation has occurred as the market matures from having been largely government supported to existing as a more independent, cost-competitive, stand-alone, renewable power industry.

Not unexpectedly, this change has had a disruptive impact on cost structures throughout China's solar industry, forcing companies to aggressively work internally – and with key partners – to optimize processes and maximize cost of ownership for each step in the value chain.

For example, as this “winter” period of gut-wrenching change took hold in China, companies were forced almost overnight to cut their manufacturing costs by 35-45% in order to meet lower selling prices for solar modules. Cost cutting had to occur in all parts of the value chain, from poly silicon to wafering to cell fabrication to module manufacturing and system integration.

LOWER COSTS/HIGHER QUALITY: FROM KENTUCKY, USA COMES A SOLUTION

CRS Reprocessing Services, LLC (CRS) was actively engaged in slurry reprocessing for the solar market in China as this shift to a more mature,

market-based approach was occurring. The company knew immediately that in order to continue doing business with Chinese wafer manufacturers already facing their own cost-cutting challenges, CRS would also have to find a way to cut costs while still meeting customer demands for high-quality reprocessed slurry.

CRS began the search for solutions by implementing its established Continuous Improvement Process (CIP), which focuses on achieving “incremental improvement” in products, services or processes over time, as well as more immediate “breakthrough improvement.” CRS has successfully used this process to

help customers around the world improve their competitive positions – even in the most challenging market environments.

CIP employs one of the most widely used tools for continuous improvement, a four-step quality model called the Plan-Do-Check-Act (PDCA) cycle:

- PLAN – identify an opportunity and plan for change
- DO – implement the change on a small scale
- CHECK – use data to analyze the results of the change and determine whether it made a difference

• ACT – if the change was successful, implement it on a wider scale and continuously assess the results. If the change did not work, begin the cycle again.

CRS has also used the PDCA cycle for internal evaluation of its proprietary design for slurry reprocessing. This evaluation encompasses the quality and stability of the treatment process itself, as well as CRS' own cost structure. Ultimately, CRS aims to improve its product offerings to meet the aggressive cost and quality goals of today's ultra-competitive market.

The internal evaluation CRS undertook as a means of adapting to the needs

of China's wafer manufacturing industry led the company to rethink the overall design of its reprocessing system. The original system consisted of two centrifuges, which operated in a three-step process to extract unusable material from slurry. In its next generation, the system was expanded to include filtration, resulting in a four-step process to further improve the quality of the recycled fluid.

Now in its third generation, CRS' reprocessing system has been reconfigured for slurries containing hygroscopic glycol-based materials such as polyethylene glycol (PEG) or di-ethylene glycol (DEG). Steps have now been added to dry the recovered



carrier fluid, resulting in an improved recovery rate and improved quality of the recovered fluid.

This latest iteration of CRS' reprocessing system was achieved using a lean engineering approach that aims to identify and eliminate costly forms of waste:

- Excess or insufficient inventory, including virgin, used, partially processed or completely processed material
- Overproduction or production ahead of demand
- Over processing resulting from poor tool or product design
- Defects that compromise the manufacturing process

By carefully examining its processing system and eliminating any possible waste, CRS was able to meet its identified goals of reducing capital cost by 40-50%, reducing energy requirements by 20-30%, and maintaining a high level of quality in the reprocessed slurry.

CHALLENGES MET: THE NEW PROCESS BRINGS POSITIVE RESULTS

CRS was in the first few months of a slurry reprocessing operation for an Asian solar wafer manufacturer when both parties detected the need for some improvements to the system. Although the recycled slurry met the agreed-upon specifications, the manufacturer presented a new challenge: reducing water content in the slurry.

CRS immediately put its Continuous Improvement Process into action, using the PDCA cycle:

- PLAN – Devise a method for dehydrating the recovered fluid to reduce water content
- DO – Install the dehydration step to the operating system
- CHECK – Perform controlled testing on a small scale
- ACT – Following successful small-scale testing, incorporate the additional process step into the overall system design on a full-scale basis

The Plan, Do and Check process required less than six weeks to complete. Furthermore, upon full implementation, this process improvement did exactly what the customer wanted it to, and the result was a 1.8% increase in overall wafer yield.

CRS was able to achieve success in this case, and others, by using the skill and knowledge gained in over 30 years' experience to create a highly technical, carefully controlled scientific process to meet – and even exceed – the needs of a valued customer competing in a marketplace that grows more competitive with each passing day.

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Using its Continuous Improvement Process, CRS was able to reconfigure the design of its slurry reprocessing system to help one Asian manufacturer achieve a 1.8% increase in overall wafer yield.