Trace contaminants in polysilicon have great impact on silicon based solar photovoltaic devices (PV). Metal contamination control is one of the key processes to improve device yield, reliability, and lifetime.

**Trace contaminants in the polysilicon can be roughly divided into two different categories according to the source:**

- Contaminants from the starting material, which ranges from approximately 1 to 10 parts-per-million (ppm) in total metals for high purity solar grade polysilicon, to 0.1 to 1% in total for metallurgical grade polysilicon.
- Process related contaminants. That is, contaminants linked to the manufacturing processes, environment, and equipment, among others.

**Figure 1**

The figure shows the monitoring results for 60 polysilicon samples. It can be seen that the spikes of contaminants are rather random and no obvious trend to follow. Close monitoring for trace contaminants is necessary to maintain consistency of device lifetime.
Depending on the purity of the polysilicon starting materials and the process for PV cell manufacturing, contaminant from either category can become the limiting factor for contamination control for the solar PV cell. Contaminants in the starting polysilicon material can be tested by either bulk digestion (for bulk trace metals) and/or surface extraction (for surface trace metals). Process related contamination can be monitored with the same testing methods by strategically designing the test points before and/or after critical process steps to pin-point the contaminating steps and identify potential source of contamination.

Figure 2 shows the trace metal results of polysilicon chunk before crushing in comparison to polysilicon crushed once (Round 1) and twice (Round 2). As presented the concentrations of cobalt, iron, and tungsten increase significantly. Iron contamination came from the steel component, impurity on the tools, and/or other sources; cobalt and tungsten were most likely from the tungsten carbide tools used as there was no other source for them.

Figure 3 provides further clues to the cobalt and tungsten contamination in this process. The three major contaminants from the powder waste generated during the crushing process were cobalt, iron, and tungsten, matching the results in the processed polysilicon precisely, except in this case the concentration levels are much higher. The cobalt and tungsten contamination introduced during the crushing process can be removed, to a very large extent, by simply acid-washing the polysilicon.

Figure 4 shows pre and post crushing trace metal results for a polysilicon sample, and the results after it was acid washed. The cobalt and tungsten levels increased significantly after crushing process. They both decreased to levels comparable to pre-crushing after acid washing.