

Silicon crystal grower recycles grinding water using Duraflow filters.

A large international silicon crystal grower located in Washington State, has installed a water recycle system as a part of the manufacturing process. The company grows silicon crystals 4, 8, and 12 inches in diameter and 4 to 6 feet in length. After the crystals are formed, the first step in the manufacturing process is to grind down the outside diameter to a uniform smooth dimension. These grinding machines chip off pieces of silicon and use recycle water for cooling the grinding heads. Particle free water is critical for reliable operation. In the next step the uniform cylinders are then sawed into wafers, the saws are cooled directly with DI water only.

The dirty water is made up from 80% grinder water and 20% sawing water. The driving force for recycle is the cost of the sewer discharge. The process flow averages 120 gpm (ranging 80 to 200 gpm), 24 hours per day and 7 days per week. The system is equipped with 96 DF filters with 24 to 48 operating at one time with the balance on standby. Since this is a critical manufacturing process there must always be a full supply of recycle water to feed the grinders, thus the justification for a back-up filter system.

The saw water and grinding water containing 100 ppm TSS are combined in a large tank (5000 gallons). The pH is monitored and controlled to between 7.5 and 8.0. The temperature is controlled between 78 and 82 F using heat exchangers. A volumetric dose of 20 ppm of Cationic coagulant is added to effect coagulation and stabilize the filtration rate. The concentration of silicon solids are allowed to increase to 5000 ppm in the concentrating tank prior to feed to a filter press for dewatering to a solid cake for disposal.

The filtrate is monitored for conductivity and Turbidity from each bank of filters. The turbidity is always less than 1 ntu. The filtrate is combined in a grinder water feed tank where the conductivity is controlled by adding DI water to lower the conductivity to <80 micro Siemens, the range for feed back to the grinding process. This is done by allowing high conductivity DF filtrate to over flow the grinder water feed tank to the plant waste water treatment system for discharge. The percentage water recycle varies from 60 to 90% on a daily basis.

The DF filters are cleaned using Sulfuric Acid and Bleach approximately two times per week due to build-up of biological activity in the concentrations tank.

This use of DF filtration successfully recycles 42 million gallons of water per year.

