

Measuring point

1,2

Installation

pipeline, bath

Measuring task

concentration monitoring of etching agent, e.g. KOH

Texturing & Etching Bath

Introduction

The base material to manufacture photovoltaic cells are monocrystalline or multicrystalline silicon blocks. These blocks (ingots) are sawed to silicon discs or wafers of defined size. Then surface damages and impurities are removed by wet chemical etching. Special etching and texturing agents are used to optimize the wafer surface, reduce crystal damages and increase the wafer life span.

Additionally, the etching and texturing process has an advantage regarding energy input. The roughened, optimized structure is able to absorb more light and increase the efficiency of the photovoltaic cell. Various texturing chemicals can be used depending on the wafer type and desired outcome of the process. Typical alkaline etching agents are caustic soda and caustic potash solutions. Acidic etching of wafers and silicon is done with sulphuric acid, nitric acid and hydrofluoric acid. The completion steps are neutralization and the removal of residues.

Application

Alkaline or acidic etching agents remove the surface damage induced by the sawing process and texture the surface of the wafer. Acidic etching agents, like HF and HNO₃ are used for isotropic etching. Typical alkaline etching agents are caustic soda (NaOH), caustic potash (KOH) and tetramethylammonium hydroxide (TMAH) solutions. Wafer surface texturing is important to improve the light trapping into the cell and the energy absorption capacity. The major factors of influence in this process are the current bath concentration and residence time. Because of the consumption and discharge of etching chemicals during the texturing process, it is necessary to measure the concentration and temperature continuously. This insures consistent product quality and, if needed, more etching agents can be added. LiquiSonic® inline analyzers monitor the current texturing and etching bath concentration. This enables an automatic additional dosing through the incorporation in to existing process control systems.

Customer value

The LiquiSonic® analyzer provides a precise inline bath concentration measurement with real-time monitoring. This allows the process to be automatically controlled in the optimal concentration range with the maximum efficiency. LiquiSonic® is used to avoid an underdosage or overdosage of etching solution.

The robust sensor construction and the optional special materials, like Halar oder PFA, promote long process life.

LiquiSonic® enables a reduction of labor cost through the elimination of manual process steps:

time saving: 1 h per day

cost per hour: 50 € (60 \$)

total cost savings: 10.000 € (12,000 \$) per year

The avoidance of insufficient dosages saves material costs and secures constant process quality.

Investment: approx. 12.000 € (15,000 \$)

Amortization: approx. 12 month

Installation

The LiquiSonic® immersion sensor is easily installed into the bath circulation pipeline or directly in the texturing or etching bath.

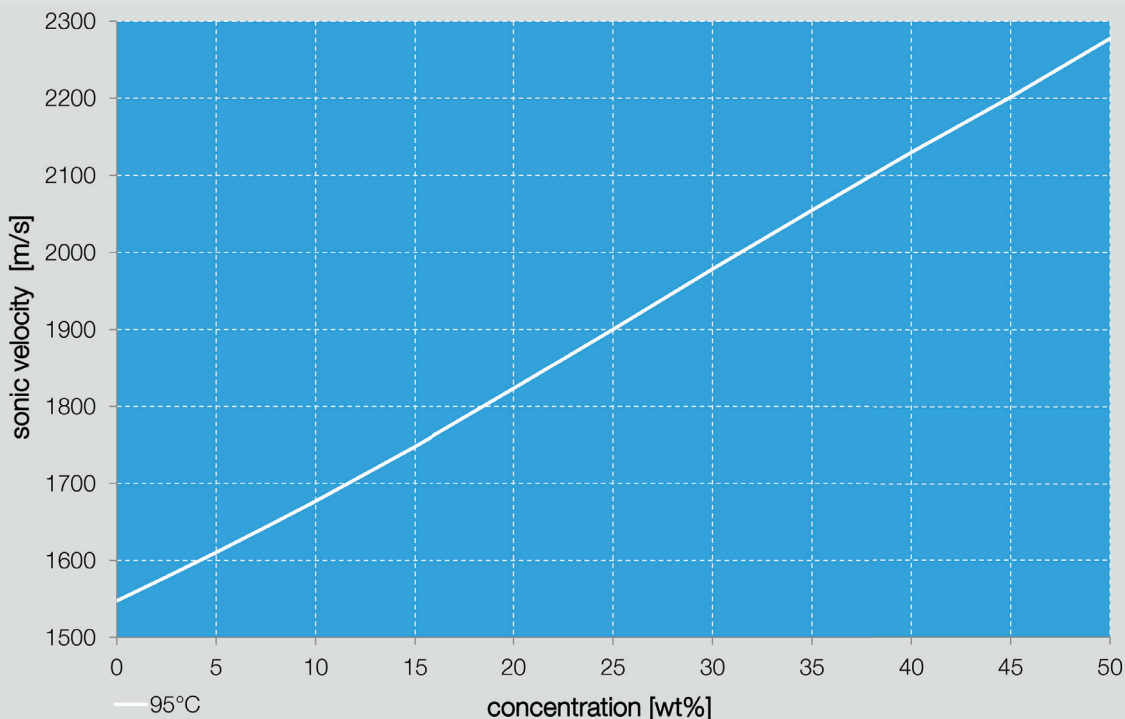
By using the LiquiSonic® controller 30, up to four sensors can be connected, allowing the simultaneous monitoring of several measuring points.

Typical measuring range:

concentration range: 0 to 55 wt%

temperature range: 80 to 120 °C (170°F to 250°F)

LiquiSonic® sonic velocity measurement in KOH solution



LiquiSonic® 30



21001311
LiquiSonic® Controller 30 V10



21010112
Immersion sensor V10 40-14, DIN DN50, L092



21004350
T-adaptor for immersion sensor DN50-50-50 PN16

BUS

21004435
BUS connection: Profibus DP



21004449
Network integration



21004110
High power sensor electronic



21004202
Bus cable indoor (100m)



21007846
Factory acceptance test (FAT) certificate



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