

# **Thermodynamic and experimental investigations of the phosphorus removal from molten silicon for photovoltaic applications**

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**Abstract:** Purifying silicon to a certain degree is needed in the photovoltaic industry. In the metallurgical route, phosphorus is removed from molten silicon in an induction vacuum refining furnace. This study presents the simulation of the silicon dephosphorization process that takes into account a neglected factor thus far, namely the residual oxygen amount.

A thermodynamic assessment is performed for the Si-P system, and the phosphorus solubility in silicon is determined. Resulting activity coefficients are incorporated in an algorithm created to simulate this phenomenon. By also using other literature data, this program predicts the distillation time of a n-type silicon sample as well as its weight loss as a function of the oxygen pressure in the enclosure.

The experimental validation of those results is intended with an electromagnetic levitation device. It enables to melt a silicon sample without any contaminant crucible and under a controlled atmosphere.

**Keywords:** photovoltaic silicon, dephosphorization, thermodynamic assessment, Hertz-Knudsen equation, electromagnetic levitation.