

## Accepted Manuscript

The effects of impurity on the stability of Horizontal Ribbon Growth

Jiaying Ke, Aditya S. Khair, B. Erik Ydstie

PII: S0022-0248(17)30601-2

DOI: <https://doi.org/10.1016/j.jcrysgro.2017.09.034>

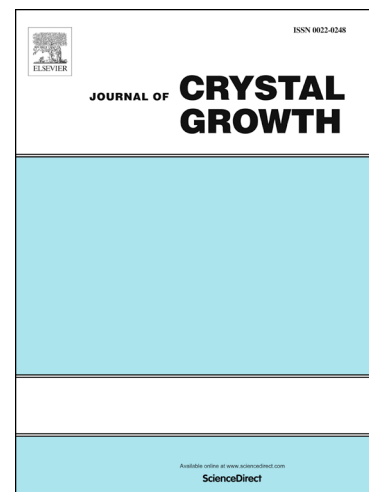
Reference: CRYG 24320

To appear in: *Journal of Crystal Growth*

Received Date: 23 June 2017

Revised Date: 28 September 2017

Accepted Date: 30 September 2017



Please cite this article as: J. Ke, A.S. Khair, B. Erik Ydstie, The effects of impurity on the stability of Horizontal Ribbon Growth, *Journal of Crystal Growth* (2017), doi: <https://doi.org/10.1016/j.jcrysgro.2017.09.034>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

# The effects of impurity on the stability of Horizontal Ribbon Growth

Jiaying Ke, Aditya S. Khair, B.Erik Ydstie

*Department of Chemical Engineering, Carnegie Mellon University*

*Pittsburgh, Pennsylvania 15213, USA*

---

## Abstract

This paper quantifies the effects of different operating conditions on the stability of the crystallization interface in the horizontal ribbon growth (HRG) process. Specifically, we perform a linear stability analysis of the base state, and we derive the profiles for thermal, solutal and flow fields with regard to small-amplitude normal mode perturbations of the base state. Within the velocity boundary layer induced by the removal of solid ribbon, a linear Couette flow is assumed; at the outer edge of the boundary layer, all perturbations are assumed to dissipate. Critical operating conditions and the unstable modes have been identified. To that end, we demonstrate that fast pulling velocity (greater than 100 mm/min), low wedge factors (the ratio of the length to the thickness of the wafer is less than 500), and insufficient heat removal (temperature gradient  $G_l$  is less than 200 K/cm) lead to instabilities. A finite bandwidth of wavenumber for instability occurs for all the unstable modes.

*Key words:* A1. Computer simulation, A1. Heat transfer, A1. Impurities, A2. Growth from melt, B2. Semiconducting silicon, B3. Solar cells

## Highlights

- Linear stability analysis is performed for the Horizontal Ribbon Growth process
- Dispersion relations are derived to demonstrate unstable modes
- The marginal stability curve is computed to guide stable experimental operation

Download English Version:

<https://daneshyari.com/en/article/5489046>

Download Persian Version:

<https://daneshyari.com/article/5489046>

[Daneshyari.com](https://daneshyari.com)