

Accepted Manuscript

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PII: S0022-0248(18)30086-1

DOI: <https://doi.org/10.1016/j.jcrysgro.2018.02.033>

Reference: CRYG 24502

To appear in: *Journal of Crystal Growth*

Received Date: 1 September 2017

Revised Date: 21 February 2018

Accepted Date: 25 February 2018

Please cite this article as: A. Ubukata, H. Sodabanlu, K. Watanabe, S. Koseki, Y. Yano, T. Tabuchi, T. Sugaya, K. Matsumoto, Y. Nakano, M. Sugiyama, Accelerated GaAs growth through MOVPE for low-cost PV applications, *Journal of Crystal Growth* (2018), doi: <https://doi.org/10.1016/j.jcrysgro.2018.02.033>

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Accelerated GaAs growth through MOVPE for low-cost PV applications

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The high growth rate of epitaxial GaAs was investigated using a novel horizontal metalorganic vapor phase epitaxy (MOVPE) reactor, from the point of view of realizing low-cost photovoltaic (PV) solar cells. The GaAs growth rate exhibited an approximately linear relationship with the amount of trimethylgallium (TMGa) supplied, up to a rate of 90 $\mu\text{m}/\text{h}$. The distribution of growth rate was observed for a two-inch wafer, along the flow direction, and the normalized profile of the distribution was found to be independent of the precursor input, from 20 to 70 $\mu\text{m}/\text{h}$. These tendencies indicated that significant parasitic prereaction did not occur in the gaseous phase, for this range of growth rate. GaAs p-n single-junction solar cells were successfully fabricated at growth rates of 20, 60, and 80 $\mu\text{m}/\text{h}$. The conversion efficiency of the cell grown at 80 $\mu\text{m}/\text{h}$ was comparable to that of the 20 $\mu\text{m}/\text{h}$ cell, indicating the good quality and properties of GaAs. The epitaxial growth exhibited good uniformity, as evidenced by the uniformity of the cell performance across the wafer, from the center to the edge. The result indicated the potential of high-throughput MOVPE for low-cost production, not only for PV devices but also for other semiconductor applications.

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