NREL
NATIONAL RENEWABLE ENERGY LABORATORY

Low-Defect Heteroepitaxy on Porous Si Substrates

Cooperative Research and Development Final Report

CRADA Number: CRD-13-534

NREL Technical Contact: Benjamin Lee

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In accordance with Requirements set forth in Article XI.A(3) of the CRADA document, this document is the final CRADA report, including a list of Subject Inventions, to be forwarded to the Office of Science and Technical Information as part of the commitment to the public to demonstrate results of federally funded research.

Parties to the Agreement: Crystal Solar

CRADA Number: CRD-13-534

CRADA Title: Low-defect Heteroepitaxy on Porous Si Substrates

Joint Work Statement Funding Table Showing DOE Commitment:

Estimated Costs	NREL Shared Resources
Year 1	$ 30,000.00
Year 2	$ 00.00
Year 3	$ 00.00
TOTALS	$ 30,000.00

Abstract of CRADA Work:

In this collaboration, NREL will grow Ge, SiGe, and III-V layers on porous Si (pSi) substrates prepared either by Crystal Solar or at NREL. The intent is to grow low-defect epitaxial III-V alloys using the porous Si layer to prevent defect formation. Finally, we aim to fabricate solar cells from the III-V layers to prove the electronic quality.

Summary of Research Results:

NREL grew Ge, SiGe and GaAs layers on top of porous Si prepared by Crystal Solar and shipped to NREL. The growth of Ge and SiGe was done by hot wire CVD (HWCVD), while GaAs growth was done by MOCVD. The grown layers were examined by optical microscopy and also transmission electron microscopy (TEM). Unfortunately the grown films were highly defective, even after some attempts at optimization. Thus, our hope that the porous Si substrate would allow low-defect epitaxial growth of III-V materials was not realized. We did not proceed to make devices or solar cells since the III-V growth experiments had negative results. In the course of the collaboration we also evaluated the quality of some Si wafers grown epitaxially by Crystal Solar, making minority carrier lifetime measurements. The quality of Crystal Solar epitaxial Si wafers is good, with minority carrier lifetimes of several hundred microseconds.

Subject Inventions Listing: None.

Report Date: 11/10/14 **Responsible Technical Contact at Alliance/NREL**: Benjamin Lee

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