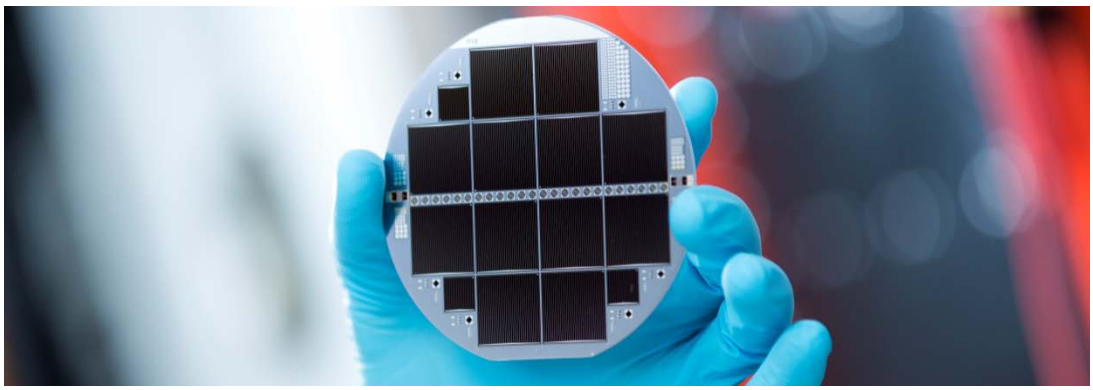
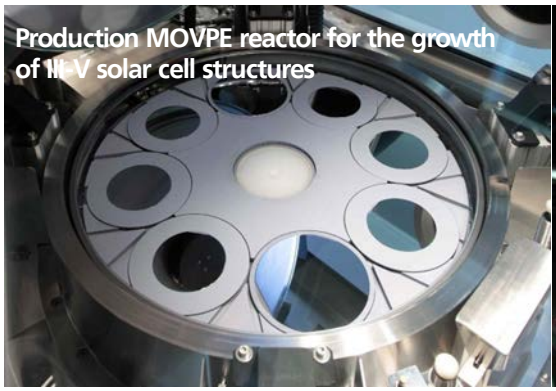
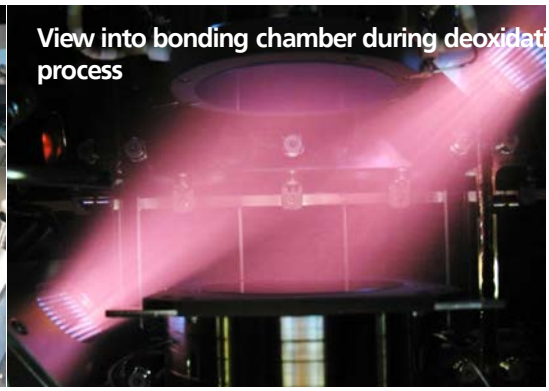




Production MOVPE reactor for the growth of III-V solar cell structures



View into bonding chamber during deoxidati process

Job opportunity for PhD Student:

„III-V Epitaxy Development for High-efficiency III-V//Si Tandem Solar Cells“

Fraunhofer-Institute for Solar Energy Systems ISE
Heidenhofstraße 2, 79110 Freiburg
Department „III-V Photovoltaics and Concentrator Technology“

What to expect

The Fraunhofer-Institute for Solar Energy Systems ISE is the largest Solar Energy Research Institute in Europe. The Institute's work ranges from fundamental scientific research relating to solar energy applications, through the development of production technology and prototypes, to the construction of demonstration systems. This PhD thesis will be hosted in our department „III-V Photovoltaics and Concentrator Technology“.

At Fraunhofer ISE III-V single- und multi-junction solar cells are being developed for nearly two decades. This technology is being used to provide power for satellites. On earth, they are at the core of concentrator photovoltaic modules with conversion efficiencies up to 38.9%. The advantage of the III-V materials is the flexibility to engineer absorption by changing the composition of the semiconductor. By combining several subcells in a multi-junction cell, highly efficient solar cells can be formed. Our department currently holds the world record for the highest conversion efficiency of sunlight into electricity of 46%. These solar cells are used under the concentrated sunlight of a Fresnel lens which is still a niche application. For using the III-V

technology in a wider market range, significant cost reduction of materials and processes is necessary. One attractive way is to combine thin III-V absorbers with a conventional silicon bottom cell. Using a technology of wafer bonding we have recently realized a GaInP/GaAs//Si triple-junction solar cell with 33.3% efficiency. This is an outstanding achievement which has been widely recognized by the PV community. During this PhD thesis, the solar cell structure shall be further improved. For this, the III-V epitaxy process (metal-organic vapor phase epitaxy) is further investigated and important parameters like lifetime of minority carriers, diffusion length, interface recombination are optimized. Also the bandgap energies of the absorbers will be increased to reach a better match to the AM1.5g spectrum. The process optimization is guided by material characterization and theoretical modelling. Fraunhofer ISE hosts a wide range of characterization tools including x-ray diffraction, photoluminescence, in-situ EpiTT, AFM, Hall and ECV measurements, SEM, cathodoluminescence, etc.

You support our research projects with funding by the German BMWi and European Union and work closely together with a young international team of scientist, engineers, technicians and graduate students. The topic of this PhD thesis is a hot topic in photovoltaics and allows highly ranked publications. We look for a highly motivated candidate with very good grades and the joy to engage in a complex but rewarding development project.

Your tasks are

- growth optimization of III-V epitaxial layers by metal-organic vapor phase epitaxy
- characterization of III-V semiconductor layers by X-ray diffraction, photoluminescence, in-situ EpiTT, AFM, Hall and ECV profiling, SEM, cathodoluminescence, Candela, etc.
- Wafer bonding of III-V layer structures to silicon and characterization of the bond interface by e.g. scanning acoustic microscopy
- Modelling of solar cell characteristics, evaluation of solar cell results and definition of improvement potential and path

The assets you provide

- Masters in physics or related scientific discipline
- profound knowledge about semiconductor physics, organo-metallic vapor phase epitaxy, characterization of semiconductors and solar cells
- deep understanding of III-V semiconductor devices
- experienced MS-Office user
- ability to thrive in a team, self contained, self dependent and highly motivated work ethics and confident appearance
- proficiency in English (spoken and written)
- open for flexible working hours

Scientific Contact at Fraunhofer ISE:

If you are interested in this PhD thesis, please apply before 10.01.2018 on the Fraunhofer ISE website: www.ise.fraunhofer.de under Jobs, Dissertations, Kennziffer: ISE-2017-343

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