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Overview of solar cell research and development and approaches to automobile applications

Development of high-efficiency solar cell modules and new application fields are very important for further development of PV (photovoltaics) and the creation of new clean energy infrastructure based on PV. For this end, further development of science and technology of PV is necessary. This paper overviews PV R&D activities in Japan as the PV R&D former Project Leader of NEDO and JST. Present status of various solar cells efficiencies under NEDO and JST PV R&D projects are presented. 44.4% for concentrator III-V compound 3-junction solar cell, 37.9% for 1-sun III-V compound 3-junction cell, 26.7% for single-crystal Si cell, 22.9% for CIGS cell and 14.0% for a-Si based 3-junction cell. Efficiency potential of various solar cells is also discussed. Future prospects of PV and our recent approaches towards the creation of “Mobility Society by using Solar Energy” are discussed. Very large-scale installation of PV power systems is needed and thus the development of ultra-high performance, low cost and highly reliable solar cells are very important. In addition, development of low cost and long lifetime batteries, highly reliable and intelligent system technologies such as smart grids is necessary. We are now challenging III-V/Si tandem solar cells. Because III-V/Si tandem solar cells have great potential for high-efficiency, low-cost and light-weight solar cells. Automobile applications by using solar energy are also very important and very attractive. Recently, we have developed high-efficiency (32%) InGaP/GaAs/InGaAs thin-film 3-junction solar cells module with an area of 32cmx32cm and 33% efficiency InGaP/GaAs/Si mechanically stacked 3-junction solar cell. Those are expected to be one of the seeds for solar electric vehicle applications.

Biography

Masafumi Yamaguchi is Professor Emeritus at the Toyota Technological Institute (TTI), Nagoya, Japan and Senior Research Scholar of the Research Center for Smart Energy Technology (SET) at the TTI. He is also a Visiting Professor of the Kyushu University and Chairman, Research Committee of the Super High Efficiency Solar Cells, Japan Society for Promotion of Science (JSPS)

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