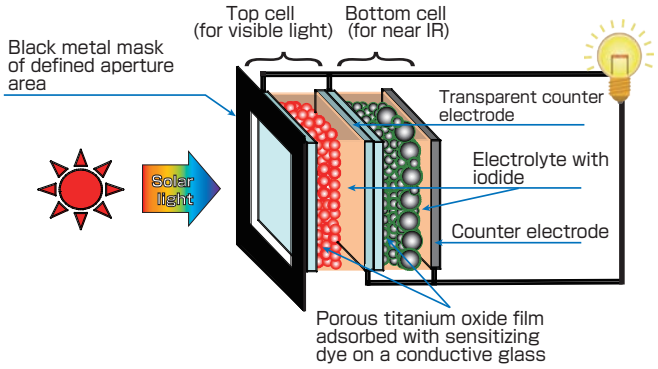
Development of an efficient tandem type dye-sensitized solar cell

New architecture of dye-sensitized solar cells for higher conversion efficiency

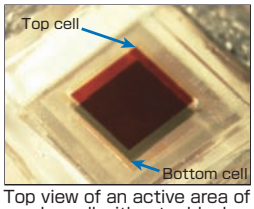
Dye-sensitized solar cells are expected to be next generation solar cells because of possible low cost production. In order to improve the solar light to electricity conversion efficiency, we examined a tandem type dye-sensitized solar cell. In a tandem cell, the top cell converts shorter wavelength light energy to electricity, and the bottom cell converts longer wavelength light energy. We have developed a new process of preparation of highly transparent nano-structured titanium oxide film electrode for the top cell and multi-layered film electrode for the bottom cell. The conversion efficiency of 11.0 % was demonstrated by using conventional Ru complex dyes as sensitizers. Higher conversion efficiency will be realized when we develop high performance sensitizers optimized for tandem type solar cells.

Hideki Sugihara
Energy Technology Research Institute
sugihara-hideki@aist.go.jp

AIST TODAY Vol.8, No.6 p.24 (2008)



Schematic presentation of a tandem dye-sensitized solar cell



Top view of an active area of a solar cell without a black metal mask

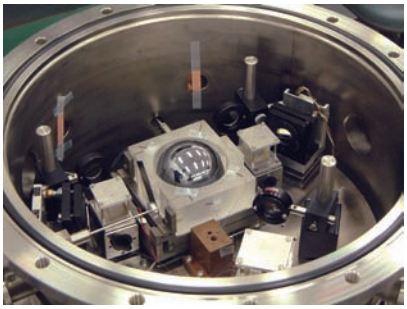
Accurate measurement of the volume of silicon spheres

Interferometeric determination of the sphere volume for the redefinition of the kilogram based on an atomic mass

Many of the units of physical quantities, such as frequency, length, voltage, resistance, and time are defined using physical laws or quantum effects which are considered to be universal and immutable. In contrast, the kilogram, the unit of mass, has continued to be based on a material artifact. The Avogadro constant is a fundamental physical constant that expresses the number of atoms or molecules contained in 1 mol of a substance. Therefore, an accurate determination of this constant would enable the kilogram to be defined based on an atomic mass. An interferometer equipped with a direct optical frequency tuning system has been developed for a determination of the Avogadro constant by the X-ray crystal density method. The volume of 1-kg silicon spheres is determined by this interferometer with a relative standard uncertainty of 3.0×10^{-8}, being the smallest uncertainty achieved for the silicon spheres to date. At present, an international project for the precise determination of the Avogadro constant is on-going. This interferometer is playing an important role in this project. An isotropically enriched silicon crystal is used in this project to further increase the accuracy of the Avogadro constant. This would realize the redefinition of the kilogram.

Naoki Kuramoto
Metrology Institute of Japan
n.kuramoto@aist.go.jp

AIST TODAY Vol.8, No.4 p.30 (2008)



An interferometer equipped with a direct optical frequency tuning system to determine the volume of 1-kg silicon spheres. A 1-kg silicon sphere is placed in the center of the interferometer. The diameter of the sphere is about 94 mm.