CIS 系太陽電池の研究開発動向

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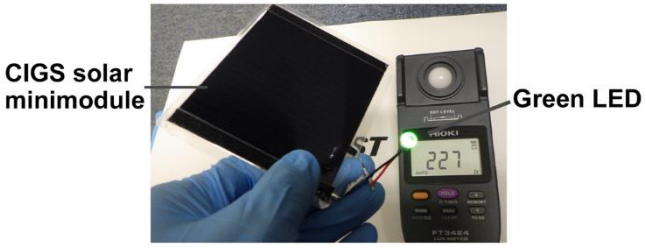
Trends in Research and Development of $CuInSe_2$ (CIS)-Based Photovoltaic Solar Cells (*National Institute of Advanced Industrial Science and Technology*) ○Shogo Ishizuka

$CuInSe_2$ (CIS) and its derivative materials such as $CuGaSe_2$, $Cu(In,Ga)Se_2$ (CIGS), and $Cu(In,Ga)(S,Se)_2$ are versatile, cost-effective, and thus, attractive for applications in photovoltaic energy conversion devices. Their band-gap energy values are controllable in a wide range with the choice of elements and their composition ratios, for example, 1.0 eV ($CuInSe_2$)－1.3 eV ($CuIn_{0.5}Ga_{0.5}Se_2$)－1.7 eV ($CuGaSe_2$). CIS-based thin-film technologies are expected to realize highly efficient lightweight and flexible solar cells and also tandem type solar cells, which may cover different markets from those of conventional silicon-based solar cells. Also, CIS-based solar cells can be useful light-harvesting devices even under relatively low illumination conditions, and thus, have applications for both indoor and outdoor use[1]. In this talk, the current status of research and developments of CIS-based photovoltaics, in particular, lightweight and flexible solar minimodules and tandem type solar cells fabricated in our laboratory are focused on, and the future direction of CIS-based solar cells is discussed.
Keywords: $CuInSe_2$; $Cu(In,Ga)Se_2$; Solar Cell; Thin-Film; Alkali-Metal

$CuInSe_2$（CIS）系化合物は多用途な低コスト光エネルギー変換材料として魅力的な材料群である。構成元素の選択や組成比により、例えば $Cu(In,Ga)Se_2$（CIGS）では、CIS の 1.0 eV から $CuGaSe_2$ の 1.7 eV まで広範な禁制帯幅制御が可能である。薄膜材料の特長を活かした高性能な軽量フレキシブル型太陽電池や、多接合型太陽電池の作製も可能であり、従来の結晶シリコン系太陽電池とは異なる市場が期待される。また、比較的低照度環境下における使用も可能であり、屋外はもちろんのこと、屋内での使用にも期待できる [1]。ここでは特に、CIS 系による軽量フレキシブル型と多接合型の太陽電池の研究開発例を紹介し、今後期待される方向性を議論する。



A photograph of usage of a CIGS minimodule lighting a green LED under approximately 200 lx illumination.

1) Lightweight and flexible $Cu(In,Ga)Se_2$ solar minimodules: toward 20% photovoltaic efficiency and beyond. S. Ishizuka, Y. Kamikawa, J. Nishinaga, *npj Flex. Electron.* **2022**, *6*, 90.