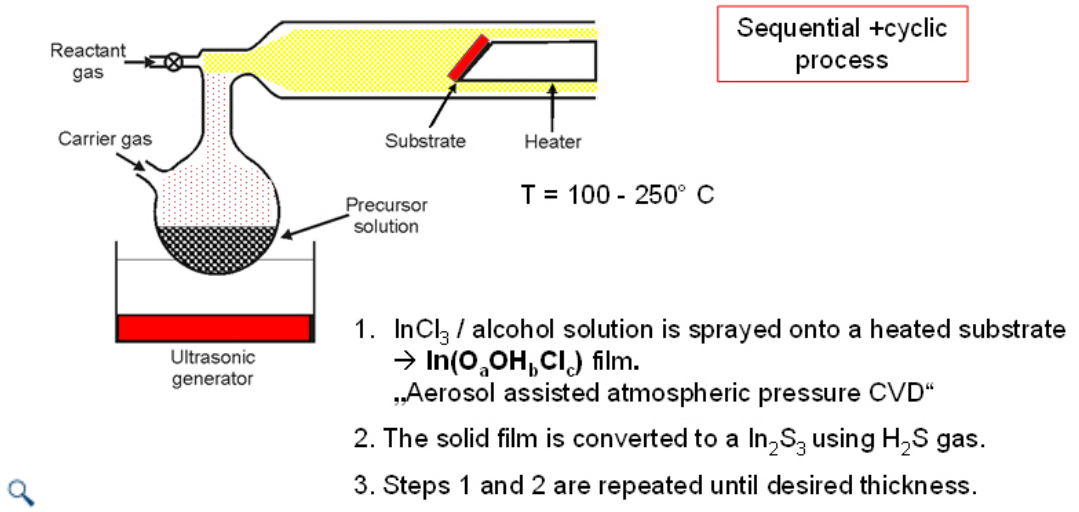
Hiden Reference: AP0192
Hiden Product: HPR-60 MBMS

The reaction mechanism of the spray Ion Layer Gas Reaction process to deposit In_2S_3 thin films

Ion Layer Gas Reaction 'ILGAR' is a non vacuum, thin film deposition technique characterized by economic material consumption, low cost equipment and easy control of the chemical composition and physical properties. In addition to developing the deposition techniques and extending the materials pallet that can be deposited and that include, among others, In_2S_3, ZnO and ZnS, we are active in developing prototypes for the up scaling and in-line production of materials by the ILGAR technique.



Above is a schematic representation of the laboratory scale Spray-ILGAR set up, used for substrate sizes up to 5 x 5 cm². The individual steps of the cyclic process are also indicated. These include the deposition of the precursor solution via aerosol assisted CVD (at atmospheric pressure), and the conversion of the deposited $In(O_aOH_bCl_c)$ film into In_2S_3 by H_2S.

To investigate the deposition process the ILGAR spray chamber fitted with a mass spectrometer which was custom built by Hiden Analytical. The system, provided by Hiden, is a HPR-60 Molecular Beam Sampling System with an integrated multi-stage pumping system and HAL quadrupole mass spectrometer. This allowed us to track the intermediate and side gases produced in the process. This gave us a deeper understanding of our reaction and better process control.

By the ILGAR process, In_2S_3 buffer layers have been developed on $Cu(In,Ga)(Se,S)_2$ in solar cells with equal efficiencies and damp-heat stabilities as the standard toxic CdS buffer layer . So far, best efficiencies of 16.1% certified by ISE Freiburg [2005], and very recently a 16.8 % efficiency-cell have been achieved [2011]. Equally important for the implementation are the very large processing windows in terms of layer thickness and process temperature and the robustness of the method, as well as its potential for rapid in-line processing and its reproducibility. In parallel we are working on the up-scaling of the ILGAR technique to larger sizes, which are more relevant to the industry.

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Martin Krüger and Sophie Gledhill with the mass spectrometer attached to the 'specially' built ILGAR tube (manufactured by Hiden)

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Hiden Product:
HPR-60 MBMS - Molecular Beam Sampling Mass Spectrometer

Follow the link to the product catalogue on our website for further information
http://www.hidenanalytical.com/index.php/en/product-catalog/182-gas-analysers-hpr-series/443-hpr-60-molecular-beam-sampling-mass-spectrometer