The Design and Construction of an X-ray Diffractometer

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http://www.treehugger.com/clean-technology/199-new-thin-film-solar-efficiency-record.html



http://www.microscopy.ethz.ch/bragg.htm





Thickness: from less than a nanometer up to a few micrometers
Uses: Optics and electronics





http://www.dma.co.nz/word/wp-content/uploads/2010/09/cd.jpg

http://www.phonearena.com/phones/Apple-iPhone-5_id7378

What are thin films?

- What we study:
 - Microstructures
 - Impurities
 - Stress



Thin Film Photovoltaic Cell

http://blogs.indium.com/blog/thin-film-technology

What are thin films?

Crystallography 3 Dimensional Packing Millor Indices

Miller Indices





http://chemwiki.ucdavis.edu/Wikitexts/UC_Davis/UCD_Chem_124 A%3A_Kauzlarich/ChemWiki_Module_Topics/The_Unit_Cell

http://www.iue.tuwien.ac.at/phd/ungersboeck/node24.html



Diffractometer

Bragg's Law



http://www.microscopy.ethz.ch/bragg.htm

$n\lambda = 2dsin\theta$



http://whs.wsd.wednet.edu/faculty/busse/mathhomepage/busseclasses/radiationphysics/lecturenotes/chapter7.html



Bremsstahlung and Characteristic



http://hyperphysics.phy-astr.gsu.edu/hbase/quantum/xrayc.html

- The Bragg-Brentano Diffractometer
 - $\circ \theta 2\theta$ geometry
 - Fixed radii
 - Sample always at the center



Design of the Diffractometer



Inside the X-ray Source





Mechanical Design



Side View

Mechanical Design





The stepper motors





• Testing of the Source



• Testing of the Source

What We've Done

- Construction of the mechanical system
- Programming of Electronics
- Preliminary testing of the x-ray source

Future Plans

- Collimation of x-ray beam
- Shielding
- Interlocking safety system

Questions?