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Introduction to Thin Film

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INTRODUCTION

A slight film is a layer of material running from parts of a nanometer (monolayer) to a few micrometers in thickness. The controlled combination of materials as dainty movies (a procedure alluded to as statement) is a crucial stride in numerous applications. A well known illustration is the family unit mirror, which ordinarily has a slight metal covering on the back of a sheet of glass to shape an intelligent interface. The procedure of silvering was once generally used to deliver mirrors, while all the more as of late the metal layer is stored utilizing systems, for example, sputtering. Propels in meager film affidavit strategies amid the twentieth century have empowered an extensive variety of innovative leaps forward in ranges, for example, electronic semiconductor gadgets, LEDs, optical coatings such antireflective coatings), hard coatings on cutting apparatuses, and for both vitality era (e.g. meager film sun powered cells and capacity (flimsy film batteries). It is likewise being connected to pharmaceuticals, by means of slim film drug conveyance.

The start of "Flimsy Film Science" can be followed to the perceptions of Grove who noticed that metal movies were shaped by sputtering of cathodes with high vitality positive particles. From that point forward it has made some amazing progress and today it is no more a subject of some easygoing scholastic hobby however has turned into an undeniable order. The amazing ascent in dainty film inquires about is, doubtlessly because of their broad applications in the various fields of gadgets, optics, space science, airplanes, resistance and different commercial enterprises. These examinations have driven a various creations in the types of dynamic gadgets and detached segments, piezo-electric gadgets, small scale scaling down of force supply, correction and enhancement, sensor components, stockpiling of sun powered vitality and its transformation to other structure, attractive recollections, superconduction movies, impedance filters,reflecting and antireflection coatings and numerous others.The present formative pattern is towards more up to date sorts of gadgets, solid and half breed circuits, field impact transistors (FET), metal oxide semiconductior transistors (MOST), sensors for various applications, exchanging gadgets, cryogenic applications, high thickness memory frameworks for PCs etc.Whatever be the film thickness restrain, a perfect film can numerically be characterized as a homogenous strong material contained between two parallel planes and developed limitlessly in two bearings (x, y) however confined along the third course (z), which is opposite to the x-y plane. The measurement along z-course is known as the film thickness (d or t). Its greatness might fluctuate from a limit $d \rightarrow 0$ to any arbitary esteem say to 10 µm or more yet continually staying a great deal not as much as those along the other two headings i.e. x and y. Some of the variables which decide the physical, electrical, optical and other properties of a film - rate of statement, substrate temperature, ecological conditions,residual gas weight in the framework, immaculateness of the material to be kept, inhomogeneity f the film, auxiliary and compositional varieties of the film in restricted or more extensive zones and so

Properties of thin film :

Mechanical properties

a.The versatile moduli shouldn't be all that diverse - they are originating from the molecule particle bonds which are the same in the mass and in slim movies. Just if the quantity of iotas at or near the surface is similar to the aggregate number of particles in your slight film, you might need to mull over this. At the end of the day: just on the off chance that you consider meager to be in the request of nuclear measurements, you're holding circumstance is so seriously aggravated that you may discover extensive contrasts in the middle of mass and thin movies flexible moduli.

b.Parameters of plastic twisting like the basic yield quality (or hardness) can be far bigger than mass qualities. The explanations behind this rely on upon numerous things (not slightest on the kind of film), but rather on the off chance that you take a gander at what decides the basic yield quality in mass precious stones, you will discover characteristic length scales like the disengagement thickness (dependably ties up with some normal separation between disengagements) or the grain size. In thi, film the grain size in one heading is at most the slender film thickness, and the disengagement thickness in territories with parallel augmentation exactly 10 times the film thickness is regularly zero - notwithstanding for high separation densities, in light of the fact that the normal separation between separations may be far bigger than the film thickness.

c.Those are uplifting news, since they imply that our meager movies can take a ton of anxiety before they accomplish something radically.

d.There is an inconsequential, yet maybe unforeseen property of slight movies. On the off chance that you store a superbly fragile material like Si on an adaptable substrate, you can move up your substrate such as a rollo - and your dainty film won't break. It's only a question of the span of ebb and flow being far bigger than the film thickness.

Optical properties

There is very little to say here. The list of refraction is attached to the holding yet again ("polarization systems") and ought not change much. In the event that your mass material is straightforward at some wave length, the slight film will be significantly all the more so. Mass materials that seem murky on the grounds that the retention length of light is shorter than, say 5 µm, might be completely straightforward as a dainty layer. Indeed, even some slender metal layers (e.g. Au) get to be straightforward to obvious light

Electrical properties

Specific conductivity s:

•We dependably have s = Si(qi • ni • µi) with q, n, µ = charge, bearer fixation, and portability, separately, of the transporters included.

•Going from mass to a dainty film might change the transporter focus if the film is thin to the point that the framework turns into a two-dimensional electron gas. What might change at bigger thicknesses is the portability µ. We anticipate that something will happen when the film thickness comes into the same request of size as the mean free way of the bearers.

•If you consider it, odds are great that the conductivity will diminish. That is not exactly great, but rather, all things considered, the impact is normally not dramatic.

Electrical break down field strength EBD:

•Take a level bit of quartz 1 mm thick and put it between the two plates of a parallel-plate capacitor. Presently wrench up the voltage U. At a few (high) estimation of the voltage, the contraption will run up in smoke with a huge explosion since you have achieved the basic separate field quality EBD = U / 1 V / mm, which will be around 10.000 V / mm in your analysis.

•Now do likewise with a standard SiO2 layer from microelectronics, having a thickness of 5 nm. You will discover EBD » 10.000.000 V / cm; a worth far over the mass number, permitting you to run your coordinated circuit at extraordinarily high voltages of up to 10 V!

•Why do we have that huge change? There are a few conceivable reasons; however the issue is really not too clear, incompletely in light of the fact that the components of electrical separate in mass materials are not all that unmistakable

Critical current density jcrit

•Take an Al or Cu wire with a cross-sectional region of 1 mm2 and run some present I through it. Wrench up your current and watch what will happen. At some basic current thickness jcrit = I / 1 mm2 your wire will go up in smoke; before that it turned into a light for a brief timeframe. You will find that jcrit will be around a couple of 1.000 A / cm2.

•Now do likewise with a meager layer that you have organized into wires with a cross-area of around 1 µm2. You will locate a basic current thickness of > 105 A / cm2, again requests of size bigger than the mass worth, empowering you to run enormous streams of up to 1 mA through those interconnects in your coordinated circuit.

•Again, why do we have that vast change? For this situation it is generally clear. The volume to surface proportion of a flimsy film wire permits a vastly improved transport of the warmth produced in the wire to the expansive warmth sink "substrate" and the environment.

Applications of Thin Film Technology

•Engineering / Processing
•Tribological Applications: Protective coatings to reduce wear, corrosion and erosion,
•low lriction coatings
•Hard coatings for cutting tools
•Surface passivation
•Protection afainst high temperature corrosion
•Self-supporting coatings of refractory metals for rocket nozzles, crucibles, pipes
•Decorative coatings
•Catalysing coatings

Optics

•Antireflex coatings ("Multicoated Optics")
•Highly reflecting coatings (laser mirrors)
•Interference filters
•Beam splitter and thin film polarizers
•Integrated optics

Optoelectronics

•Photodetectors
•Image transmission
•Optical memories
•LCD / TFT

Electronics

•Passive thin film elements (Resistors, Condensers, Interconnects)
•Active thin film elements (Transistors, Diodes)
•Integrierted Circuits (VLSI, Very Large Scale Integrated Circuit)
•CCD (Charge Coupled Device)

Cryotechnics

•Superconducting thin films, switches, memories
•SQUIDS (Superconducting Quantum Interference Devices)

New Materials

•Superhard carbon ("Diamond")
•Amorphous silicon
•Metastable phases: Metallic glasses
•Ultrafine powders (diameter < 10nm)
•Spheroidization of high melting point materials (diameter 1-500µm)
•High purity smiconductors (GaAs)

(Alternative) Energies

•Solar collectors and solar cells
•Thermal management of erchitectural glasses and foils
•Thermal insulation (metal coated foils)

Magnetic Applicaions

•Audio, video and computer memories
•Magnetic read / write heads

Sensorics

•Data acquisition in argessive environments and media
•Telemetry
•Biological Sensorics

Biomedicine

- Biocompatible implant coatings
- Neurological sensors
- Claddings for depot pharmaca

References :

i.i.https://en.wikipedia.org/wiki/Thin_film
ii.http://shodhganga.inflibnet.ac.in/bitstream/10603/3702/7/07_chapter%201.pdf
iii.http://www.tf.uni-kiel.de/matwis/amat/semitech_en/kap_3/backbone/r3_4_3.html
iv.Properties and Characterization of Thin Films :http://static.ifp.tuwien.ac.at/homepages/Personen/duenne_schichten/pdf/t_p_ds_chapter1.pdf