PREPARATION OF THIN FILMS OF SOME SEMICONDUCTOR MATERIALS BY THE SOL-GEL METHOD

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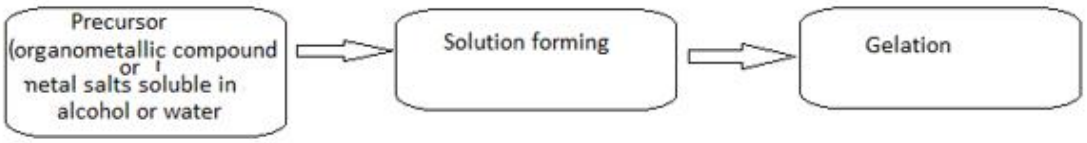
The sol-gel method preparing thin film build on sol-gel processing, as wet chemical method for synthesis of various semiconductor thin films. Let's describe successively the steps for obtaining thin films by this method. First of all, let's give the requirements for the choice of materials. The requirement for the choice of materials is should be soluble in alcohol or water the called sol will be obtained from this material, followed by its transfer to the gel state. The molecular precursor (usually metal alkoxide) is dissolved in water or alcohol and converted to gel by heating and stirring by hydrolysis/alcoholysis. Since the gel obtained from the hydrolysis/alcoholysis process is wet or damp, it should be dried using appropriate methods depending on the desired properties and application of the gel[1] . For example, if you have a solution of an alcoholic content, the process of transition to the gel state occurs by burning out the organic components. After the drying stage, the produced gels are powdered and then calcined. Sol-gel method is a cost effective method. The low temperature required for the reaction provides good control over the chemical composition of the products. This method can be used in the process of making ceramics as a metal oxide a projecting link between thin films of metal oxides as a molding material in various fields of their application. The materials obtained from the sol-gel method are used in various fields as optical, electronic, energy, surface engineering, biosensors, and pharmaceutical and separation technologies (such as chromatography). Sol-gel method is a conventional and industrial method for the synthesis of nanoparticles with different chemical composition. Basis of the sol-gel method is the production of a homogeneous sol from the precursors at first steps and after then its conversion into a gel. The solvent in the gel is then removed from the gel structure and the remaining gel is dried.



Properties of the gelation products depend significantly on the drying method. In other words, the “removing solvent method” is selected according to the application in which the gel will be used. Dried gels in various ways are used in industries such as surface coating, building insulation, and the production of special clothing. It is worth mentioning that, by grinding the gel by special mills, it is possible to achieve nanoparticles.

The transition from the sol state to the gel state is described for a decided semiconductor thin film.

In our case, we will give a directly executed case of semiconductor products and, based on their parameters, we can study the possibilities of this method. For the first time, we have produced by this method various semiconductor thin films such as In_2Se_3, Ga_2Se_3, $CuInS_2$, In_2S_3 and a number of others [2, 3, 4]. Let's take a look at the fabrication of semiconductor thin film In_2S_3 step by step. As you can see, this is a binary compound and for each element we will prepare a material for making a solution. According to the requirement of sol–gel method for preparation of In_2S_3 semiconductor thin film material should be

presence in solution In and S ions which supplied resolution with dissolving of initial materials both for ions In and for ions S separately. First solution for In ions weighted the corresponding quantity from the InCl3 material is obtained and was dissolved in Glacial Acetic Acid or Ethanol one hour stirring. Sulfur ion solution has been prepared separately from powder of Thiourea (CH4N2S), which also weighted according to stoichiometric calculation and solved in ethanol (C2H5OH) and stirring one hour. After then first solution drop by drop added to second solution at stirring. Stirring will continue for 24 hours. Further, with this solution, you can do some actions to prepare the solution for the next stage, that is, the gelation step. After the above steps, the resulting homogeneous solution is considered ready. After that, you can determine the parameters of the solution. These parameters can be the density of the solution, the pH parameter of the solution. The characteristics of the

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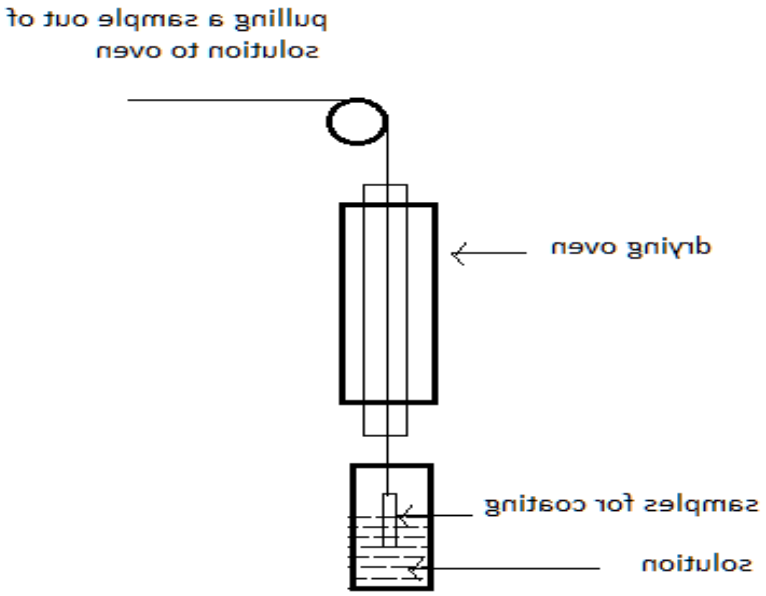
obtained semiconductor thin films can strongly depend on these parameters.

The next step is coating and gelation. Coating have also several type. For example, deep coating or spin coating.



By repeating the indicated step successively, the required thin film thickness can be obtained.

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